

Docket No. SA-537

Exhibit No. 6-A

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Survival Factors Group Chairman's Factual Report

(64 Pages)

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, DC 20594

SURVIVAL FACTORS GROUP CHAIRMAN'S FACTUAL REPORT

November 22, 2013

I. ACCIDENT

Operator : Asiana Airlines
Airplane : Boeing 777-200ER [HL7742]
Location : San Francisco, CA
Date : July 6, 2013
Time : 1128 Pacific daylight time (PDT)¹
NTSB # : DCA13MA120

II. SURVIVAL FACTORS GROUP²

Group Chairman : Jason T. Fedok
National Transportation Safety Board
Washington, DC

Member : Courtney Liedler
National Transportation Safety Board
Washington, DC

Member : Emily Gibson
National Transportation Safety Board
Washington, DC

Member : Peter Wentz
National Transportation Safety Board
Washington, DC

Member : Jin Kyung Oh
Korean Aviation and Railway Accident
Investigation Board
Seoul, Korea

¹ All times are reported in local time unless otherwise noted.

² Not all group members were present for all activities.

Member	:	YoungSun Lim Korean Aviation and Railway Accident Investigation Board Seoul, Korea
Member	:	Kathryn Reneau Federal Aviation Administration Denver, CO
Member	:	John Woodring Federal Aviation Administration Denver, CO
Member	:	Eric Brown Federal Aviation Administration Seattle, WA
Member	:	Randy Moseng Federal Aviation Administration Washington, DC
Member	:	Rob Hentges Air Cruisers Company Wall Township, NJ
Member	:	Mike Kret Air Cruisers Company Wall Township, NJ
Member	:	Paul Lacy Air Cruisers Company Wall Township, NJ
Member	:	Ed Vienckowski Air Cruisers Company Wall Township, NJ
Member	:	Sung Ky Oh Asiana Airlines Seoul, Korea
Member	:	Hee Chang Lee Asiana Airlines Seoul, Korea

Member	:	Bruce Wallace Boeing Seattle, WA
Member	:	Al Carlo Boeing Seattle, WA
Member	:	Capt. Terry Smerdel San Francisco Fire Department San Francisco, CA

III. SUMMARY

On July 6, 2013 at 11:28 am Pacific daylight time, a Boeing 777, registration HL7742, operated by Asiana Airlines as flight 214, struck the seawall short of runway 28L at San Francisco International Airport. The airplane was destroyed by impact forces and fire. Three of the 291 passengers were fatally injured. The flight was a regularly scheduled passenger flight from Incheon International Airport, Seoul, Korea, and was operated under the provisions of *14 Code of Federal Regulations Part 129*. Visual meteorological conditions prevailed at the time of the accident.

IV. DETAILS OF THE INVESTIGATION

1.0 Airplane Configuration

The airplane was configured with 24 business class passenger seats (A-zone), 271 travel-class passenger seats (157 B-zone, 114 C-zone), 2 cockpit flight crew seats, 2 cockpit observer seats, and 13 retractable flight attendant jumpseats. See figure 1. For photographs of the cabin see attachment 1.

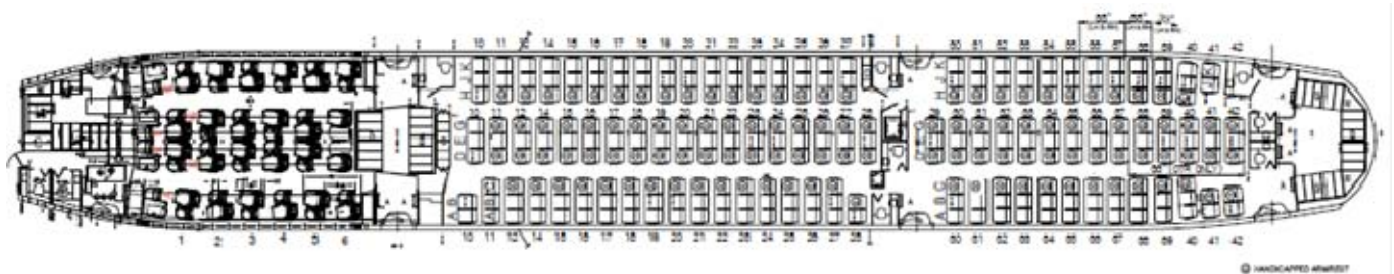


Figure 1. Cabin configuration of HL7742.

2.0 Cabin Crew Information

2.1 Flight Attendant Training Summary

Position³	Initial Training Completion	Last Recurrent Training
Cabin Manager, L1A	3/13/1995	1/25/2013
L1B	4/21/2003	4/25/2013
R1	4/8/2002	1/8/2013
L2A	6/7/1999	5/16/2013
R2A	6/11/2012	N/A
L2B	4/10/2006	6/26/2013
L3	5/3/2010	6/25/2013
R3	6/18/2012	N/A
L4	11/13/1995	6/12/2013
R4	10/4/2011	12/6/2012
M4A	4/23/2007	5/21/2013
M4B	7/02/2012	N/A

Table 1. Flight Attendant Training Information.

2.2 Asiana Airlines Flight Attendant Training Program

Upon hire with Asiana Airlines, flight attendant candidates were required to complete an approved initial training program that qualified candidates as flight attendants. The NTSB Survival Factors Group reviewed Asiana flight attendant initial and recurrent training materials. The initial course consisted of over 170 hours of training and encompassed a proficiency evaluation. Then, every 12 months Asiana Airlines flight attendants were required to complete recurrent training. The recurrent course consisted of over 14 hours of training and also encompassed a proficiency evaluation.

Included in the initial flight attendant training program were 40 hours of company procedure indoctrination. Subject areas included: the airline operation and policy, aviation laws and regulations, the flight attendant manual system, and flight attendant duty and rest regulations. The training program also included 4 hours of training on transporting dangerous goods and 8 hours of training on aviation security. Eight hours of crew resource management training were provided on conflict management, communication skills, basic human error concepts, and situational awareness. Forty-seven hours were dedicated to emergencies including such topic areas as:

³ The position designation was a combination of airplane side and door exit. For example, flight attendant R1 was positioned on the right side of the airplane at door 1, closest to the cockpit. A and B designations were used when two jumpseats were at the same door. The A position was assigned to the jumpseat on the forward partition, while the B position was assigned to the jumpseat on the aft partition. See figure 2.

- Firefighting and smoke removal procedures (Portable Breathing Equipment (PBE) and firefighting drills, hand fire extinguisher drills)
- Emergency evacuations (evacuation drills, exit drills, separation and reinstallation of a slide/raft, and evacuation slide drill), ditching (flotation device training, ditching training, slide raft boarding)
- Slide and slide/raft familiarization
- Cabin pressurization and decompression
- Ditching
- Passenger briefings

Other initial training modules included 32 hours of aircraft structure, safety policy and procedure, duties and responsibilities of flight attendants (position of cabin crew and all “phase of flight” duties and procedures), emergency procedures, emergency equipment, and aviation indoctrination. Medical and first aid training was conducted for 14 hours. Specific aircraft type training was 19 hours: including 5 hours of specific training on the B777. Aircraft type training addressed:

- Aircraft familiarization (cabin configuration, galleys, lavatories stowage areas)
- Aircraft equipment and fixtures (flight attendant stations, seats/restraints, passenger service units, cabin crew panels, passenger informational signs, aircraft markings, emergency equipment location)
- Aircraft exits (general exit information, preflighting of exits with or without slide or slide/rafts, window exits)
- Aircraft systems (communication systems, lighting systems, oxygen systems, water supply systems)

After completion of the initial ground portion of the training program, each flight attendant was required to complete 8 hours of supervised line experience training. After line experience training, the flight attendant received an evaluation on their basic knowledge and abilities required as a flight attendant including their capabilities to conduct flight attendant duties in each phase of flight and overall knowledge of cabin safety.

The Asiana Airlines recurrent flight attendant training program consisted of over 14 hours of training. Recurrent training focused on 2 hours of emergency equipment training and 1.5 hours of emergency procedures training. An additional 1.5 hour module covered the following topics:

- location and use of all emergency and safety equipment carried in the airplane
- location and use of all types of exits
- differences supplementation
- actual donning of protective breathing equipment
- actual handling of fire extinguisher

- actual donning of a life vest
- actual handling of portable oxygen bottle
- inflight decompression group drill
- unplanned emergency evacuation group drill

Additionally, Asiana F/A training rotated a 1.5 hour module on one of the following three topics on a triennial schedule:

- Ditching (drill including demonstration in the use of a life raft and handling of real or simulated pyrotechnics)
- Planned emergency (emergency evacuation group drill including a demonstration on the method used to operate a slide or slide/raft)
- Fire (firefighting using equipment representative of that carried in the airplane on an actual or simulated fire, operation of all exits, using equipment in a simulated smoke-filled environment, and a drill on the effect of smoke on an enclosed area)

The crew resource management training in recurrent training was comprised of 2 hours.⁴ Dangerous good handling, first aid, and safety policy and procedures training consisted of 2.5 hours. Aviation security was a 3 hour segment divided into a 2 hour instruction and a 1 hour drill.

2.3 Asiana Airlines Flight Attendant Manual

Excerpts from relevant sections of the Asiana Airlines Flight Attendant Manual (Revision 30, dated 06 November 2012) are included below:

⁴ A note in the recurrent training materials stated “in case that joint CRM is conducted instead of CRM class, the evaluation [is] not [needed].”

4.1 Emergency Evacuation

There are two kinds of the emergency landing: Planned emergency landing and Unplanned emergency landing.

a. In both types of emergency landing, emergency procedures are established to help crews and passengers

- 1) Protection from the impact
- 2) Escape from the aircraft
- 3) Survival from the environment

b. The basic procedures of emergency evacuation in land and on water are the same. However, in emergency landing on water, there is an additional problem, that is surviving on the surface of the water where safety is brittle floatation.

c. In a planned emergency landing, there is time to prepare the aircraft, crew, passengers and airport. Cabin crew has time to prepare the cabin and an emergency announcement can be made to brief passenger via P.A system.

d. Planned emergency landings can occur in land or on water.

e. In unplanned emergency landing, there is no time for crew to prepare for evacuation. In general, it usually occurs during take-offs and landings without any warning. The unplanned emergency landing may occur on land or on the surface of the water. The unplanned emergency landing on water is similar to the unplanned emergency landing in land, except the fact that the passengers and the crew are floating on the surface of the water.

f. In an emergency situation, the Pilot-In-Command is responsible of the emergency evacuation command from the aircraft. When the captain is unable to command, the First Officer is in charge of commanding.

g. If the first officer is unable to do so, then the cabin manager does it. If the cabin manager is incapable of doing it, then each door duty crew must perform the emergency evacuation on his or her own judgment.

h. Emergency Signal

In an emergency situation, press the All Call button three times on the interphone system and alert all cabin crew about the emergency situation.

i. Rejected Take-Off

A rejected take-off is any take-offs that have been stopped on runway after take-off action has begun. When a take-off has been rejected, cabin crew must wait for the captain's P.A. announcement or interphone call. The cabin manager follows the captain's order and controls the cabin.

j. Captain Announcement

Situation	Command
Emergency evacuation not needed	"Crew and passengers, remain seated."
	After cockpit crew announcement, cabin crew notifies passengers the emergency situation ended, tries to keep passengers calm and discusses the procedures to the captain.
Immediate evacuation needed or expected	"Attention, crew at stations."
	After cockpit crew announcement, cabin crew <u>shall</u> stand by and be ready for the emergency evacuation.
Announcement for Emergency Evacuation	"Evacuate, Evacuate (to the left/right)"
	After cockpit crew announcement, cabin crew <u>shall</u> carry on the emergency evacuation according to the standard procedures.

k. Unwarranted Evacuation

Cabin crew shall take proper measures in order to prevent unwarranted evacuation made by the passenger.

- 1) Control the cabin and the passenger.
- 2) If the agitated passenger tries to evacuate through the emergency exit, cabin crew shall deter the passenger from the action.
- 3) In order to prevent passenger's agitation during an emergency situation, make cabin announcement to let the passenger know about the situation.

4.4 Escape from the Aircraft

4.4.1 Contacting to the cockpit after the complete stop of the aircraft

- a. The captain conducts the evacuation from the aircraft after the complete stop of the aircraft and after examining the aircraft conditions through various equipments. However, if the captain or the first officer is unable to conduct an evacuation right after the complete stop and if there is no contact made to the cabin or when the cabin manager is unable to contact, then cabin crew (or cabin manager) may call the cockpit using the interphone system or visit directly and attempt to contact the cockpit.
- b. After an emergency landing, flight crew maybe occupied with the emergency duties and unable to respond to the cabin immediately. Then, (senior) cabin crew shall contact the cockpit and report the condition in the cabin.
- c. Upon hearing an evacuation signal from cockpit, emergency evacuation must be conducted immediately. "This is Captain. Evacuate, Evacuate (to the left/ right).

4.4.2 Cabin Crew Decision on Evacuation

Cabin manager contact to the cockpit first, and then, if the cabin situation is severe and evacuation is needed, Cabin manager can command to evacuate. And if cabin manager is not able to command, each door duty cabin crew may decide on the evacuation.

- a. Severe structural damage
- b. Threatening fire or smoke
- c. Passengers are in imminent danger and there is no reply from the cockpit

f. B777-200

1) Items carried by Door Duty Crew

Door Duty	Items to be carried
L1 Door	Flash Light, E.L.T
R1 Door	Flash Light, Megaphone
L2 Door	Flash Light, First Aid Kit
R2 Door	Flash Light
L3 Door	Flash Light, First Aid Kit
R3 Door	Flash Light
L4 Door	Flash Light
R4 Door	Flash Light

2) Duty of Door Duty Cabin Crew

- a) Evacuate on the captain's command.
- b) Shout "Release Seatbelt" to passengers.
- c) Check the outside condition of the aircraft through the window and decide the possibility of evacuation.
- d) If it is possible to use, shout "Come This Way."
- e) Open the door in Slide Mode Armed position, and inflate the evacuation slide.
- f) If inflation fails, pull the manual release handle attached in the girt bar and inflate the slide manually.
- g) Check that the evacuation slide has completely inflated and touched the ground, then evacuate the passengers.
- h) Ask assistance to passengers who evacuate in the first place to help other passengers behind evacuate quickly.
- i) Hold the door assist handle, stay close to the wall and not to be in the way of passengers' evacuation and start evacuating the passengers.
- j) Shout, "JUMP" and do the evacuation quickly.
- k) After passengers have evacuated the aircraft, look for any other left behind passengers, cabin crew take items with them and evacuate through the designated doors.
- l) After the evacuation, be aware of the explosion of the aircraft. Take the passengers far away from the aircraft.
- m) When reaching the safe distance away from the aircraft, count the number of passengers and notify it cabin manager.

3) Duty of By-Pass Duty Cabin Crew

- a) In emergency evacuation, cabin crew, seating near the door yet not a door duty, evacuates first. If the nearest door is unavailable for evacuation, then use other available nearest door.
- b) Help passengers to stand up straight and evacuate so that the passengers behind are also able to evacuate quickly.
- c) Assist passengers who have evacuated the aircraft move to a safe location.
- d) After the door duty crew has evacuated, then act together with them.
- e) In emergency evacuation, cabin crew, seating away from the door, guide and disperse passengers near the jumpseat to the available exits by shouting, "Go that way." (Do not drive passengers to one direction)
- f) After all passengers have evacuated the aircraft, check if there is any passenger left behind.
- g) Take passengers to a safe location, after the evacuation.

4.4.4.7 Evacuation from the Aircraft

- a. Ensure all passengers are evacuated.
- b. If the aircraft makes an emergency landing at the airport, cabin crew do not need to take something from the aircraft and just recheck whether all passengers have evacuated.
- c. If the aircraft makes an emergency evacuation somewhere remote, not the airport, then before evacuation, cabin manager or cabin crew shall take out the ELT, Megaphones, First Aid Kits and Flash lights from each zone.

4.4.4.8 After the Evacuation

- a. Gather the passengers away from the aircraft for the safety.
- b. Give first aid to the wounded passenger.
- c. Check the number of passengers and crews.
- d. Prohibit smoking.

2.4 Flight Attendant Interviews and Statements

Six flight attendant interviews were conducted on July 9, 2013. The remaining 6 flight attendants (R1, R3, L4, R4, M4A, and M4B) could not be interviewed at that time due to their injuries. The flight attendant interview summaries are included as attachment 2 of this report. Translation assistance was provided by Mr. Oh (KARAIB). Before each interview Mr. Oh provided a briefing in Korean to ensure that the flight attendants understood the purpose of the interview and how it would be conducted.

Written or typed statements were requested for all 12 flight attendants at such a time when their injuries allowed them to produce one. Asiana Airlines provided a written statement by the cabin manager as well as flight attendants L1B, R1, L2A, and L2B. A typed statement by flight attendant R3 was also received after she recovered from her injuries. Those statements (and translated versions from the U.S. Department of State) are included as attachment 3 of this report.

2.5 Evacuation Summary

The flight attendants (F/As) described a normal flight until the final approach for landing. They reported performing their seatbelt compliance checks and at least two F/As checked C-zone. Several F/As reported a sensation that the airplane was traveling or descending too quickly. Flight attendant (F/A) L2A was able to see out a window and felt they were going to impact the water and yelled for his colleague to brace herself. Some F/As reported that the airplane pitched up unusually. The F/As generally described the first impact as similar to a hard landing. One F/A reported a crushing sensation after the first impact. Some F/As stated that the first impact was followed by a sensation of lifting off again. Others reported being thrown in their restraints, or that the airplane was shaking or rolling. The F/As reported a second impact that was much more severe than the first. F/As R1 and R2A reported that the second impact caused the slide/rafts attached to their door to come free and inflate inside the cabin, pinning them in their seats. Most of the F/As reported items flying throughout the cabin, oxygen masks and ceiling panels falling down, etc.

After the airplane came to a stop, the cabin manager (seated at door 1L) ordered the junior flight attendant seated across from her to check on the status of the pilots. F/A L1B went to the cockpit and knocked on the door which was immediately opened by one of the flight crew. She ascertained that they were okay and went back to door 1L. Upon hearing them say they were okay, the cabin manager immediately went to the cockpit and asked if the flight attendants should evacuate the airplane. She was told, “No, please wait.” She went back to her jumpseat and made an announcement to passengers to remain seated. Immediately after her announcement she heard “evacuate!” Although she was unsure of who the command came from, she went to door 1L, opened it, and began to command passengers to evacuate.

F/A L2A reported that, after the airplane came to a stop he immediately realized the situation was an emergency. He made an announcement for passengers to wait while he assessed conditions and then heard F/A R2A screaming for help. Her legs had been pinned against the galley next to her jumpseat by the inflated slide/raft and could not free them. He went over to her to try to assist but it was futile. He saw fire and smoke outside the door 2R window and realized they needed to evacuate. Before he could get back to his exit he heard the cabin manager making her announcement for passengers to remain seated. He told junior F/A L2B to go to door 1L and stop her from making the announcement while simultaneously commanding the evacuation to begin in both Korean and English. He did not hear a command from a flight crew member to evacuate; he initiated the evacuation entirely on his own.

F/A 3L reported losing consciousness for a few seconds after impact. When she regained consciousness she was still restrained in her jumpseat but recognized they were in a “very bad situation.” She was confused because she heard the cabin manager make an announcement. She tried to use the interphone to independently command an evacuation, but reported it did not work. She released her seatbelt and tried to open her

door but it would not open. She recognized F/A L2A's voice when he commanded for an evacuation and shortly thereafter saw light coming from across the airplane at door 3R. Passenger 30K was there directing passengers out the door. She stayed in the area of her jumpseat and began directing passengers to evacuate from both doors 2L and 3R. F/A L3 was the only crew member in the back half of the airplane who was capable of assisting with the evacuation. All 4 F/As in the aft galley of the airplane had been ejected from the airplane during the impact sequence. F/A R3's statement indicated that, despite fastening her seatbelt before landing, she was thrown to the floor and seriously injured during impact. She recalled being assisted from the airplane through door 3R by passengers.

After most of the passengers had evacuated from the front of the airplane the cabin manager and F/A L1B both came to realize that F/A R1 was trapped in her jumpseat by an inflated slide/raft and assisted her husband (who had been seated in business class for landing) in extricating her. She was described as being unconscious with a purple face and she was assisted down the 1L slide/raft by her husband and two F/As.

At the same time, F/A R2A's legs were still pinned against the galley across from her jumpseat. She remained conscious and had managed to unfasten her restraint and fall to the floor. Several F/As and at least one member of the flight crew assisted her. When nothing could be immediately found to puncture the slide/raft, F/As who had evacuated asked for and retrieved knives from emergency responders who had arrived on scene. According to the cabin manager, she retrieved a knife from the door 2 galley and the first officer punctured the slide/raft with it. She then retrieved a fire extinguisher and the first officer attempted to extinguish an interior fire. The remaining F/As and flight crew in the front of the airplane evacuated from either door 1L or door 2L.

When all of the ambulatory passengers had evacuated in her area F/A L3 noticed that several passengers were not evacuating. She commanded them to leave but realized that some passengers were trapped. She went to the back of the airplane and tried to assist with victim extrication until firefighters arrived and she was forced to leave because of the smoke and difficulty breathing.

Once outside, the flight attendants performed various duties such as gathering passengers together, attending to injured passengers and crewmembers, and notifying responders about (and searching for) the four ejected flight attendants.

3.0 Passenger Information

According to Asiana Airlines, there were 291 passengers on flight 214. One of the passengers was a lap-held infant.

3.1 Passenger Interviews

Seven passenger interviews were conducted and interview summaries can be found as attachment 4 of this report.

3.2 Passenger Questionnaires

Passenger questionnaires were mailed to 111 passengers who provided U.S. street addresses during the week of August 26, 2013. Sixteen had been returned by passengers as of the date of this report and are included as attachment 5 of this report. Two questionnaires were returned for incorrect addresses.

4.0 On-scene Documentation

4.1 Doors and Slide/rafts

All eight of the main cabin doors were examined. Doors 1L, 1R, 2L, 2R, 3R, and 4R had no visible structural damage. Door 3L had slight bulging in the forward and aft doorway edge frame. Door 4L had separated from the airplane and was found lying 13 feet away from the exit opening.

Because of the uneven attitude of the airplane, measurements were taken from each door sill to the ground. The door sill heights to the ground were measured as follows:

- Door 1L: 110 inches
- Door 1R: 117 inches
- Door 2L: 98 inches
- Door 2R: 99 inches
- Door 3L: 53 inches
- Door 3R: 17 inches (to fuselage wreckage under door sill)
- Door 4L: 14 inches
- Door 4R: 27 inches

4.1.1 Door 1L

Door 1L was found in the open position. The door emergency power assist system (EPAS) pressure cylinder was empty (0 psi). The slide/raft bustle and packboard were attached to door and the exit arm/disarm lever was in armed position. The door hinge and release mechanisms were functional. No notable damage to door and doorway frame was detected.

Door 1L Evacuation Slide/Raft

Part number: 62771-123

Serial number: 1891

Date of Manufacture: 6/07

“Mod per 777 SB 107-25-25”

Both video evidence and flight attendant statements indicated that the 1L slide/raft fully deployed and was used during evacuation. Video evidence indicated that

the slide/raft was later punctured when firefighters placed a ladder on it to obtain access to the airplane's interior. Both the cylinder and packboard cover release safety pins stowed in the safety pin stowage pocket on the packboard cover. No anomalies were observed with the inflatable.⁵

4.1.2 Door 1R

Door 1R was found in the open position. The door emergency power assist system (EPAS) pressure cylinder was empty (0 psi). Slide/raft bustle was not attached to door and the exit arm/disarm lever was in armed position. The door hinge and release mechanisms were functional. No notable damage to door and doorway frame was detected.

Door 1R Evacuation Slide/Raft

Part number: 62771-124

Serial number: 2192

Date of Manufacture: May 2008

“Mod per 777 SB 107-25-25”

“Mod per 777 SB 107-25-30”

The door 1R slide/raft was found deflated inside airplane on the exit passageway floor extending forward into the galley and aft into the right main aisle approximately 1 to 2 feet. The slide/raft girt bar was attached to the floor fittings. The manual inflation handle was in its proper position on the girt. The inflation cable was free from the pressure cylinder valve and the inflation cylinder was empty. The door bustle was found outside the airplane next to fuselage forward near door 2R at approximately STA 630 (between the engine and the fuselage). All of the slide/raft restraints were intact and disconnected by the Survival Factors Group. (The restraints were labeled 16, 20, 25, 16 fwd, 18 fwd, 18 aft, 106 fwd, 106 aft, and 111 center.) The packboard was attached to the door with both the cylinder and packboard cover release safety pins stowed in the safety pin stowage pocket on the packboard cover. The door 1R slide/raft, packboard, and bustle were shipped to Air Cruisers Company in Wall Township, NJ to conduct a teardown examination. (See section 5.0.1)

4.1.3 Door 2L

Door 2L was found in the open position. The door emergency power assist system (EPAS) pressure cylinder was empty (0 psi). The slide/raft bustle and packboard were attached to door and the exit arm/disarm lever was in armed position. The door hinge and release mechanisms were functional. No notable damage to door and doorway frame was detected.

Door 2L Evacuation Slide/Raft

Part number: 62772-215

⁵ The term 'inflatable' refers to the inflatable part of the slide/raft, i.e. the silver portion. It does not include other parts of the slide/raft such as the packboard or bustle cover.

Serial number: 0901 (2907 on maintenance card)

Date of Manufacture: June 2002

“Mod per 777 SB 107-25-25”

“Inspected and/or mod per 777 SB 107-25-30”

Both video evidence and flight attendant statements indicated that the 2L slide/raft fully deployed and was used during evacuation. The slide/raft packboard and bustle were attached to door with both the cylinder and packboard cover release safety pins stowed in the safety pin stowage pocket on the packboard cover. No anomalies were observed with the inflatable.

4.1.4 Door 2R

The door was found in the closed position and was fire damaged. The door handle was found in an approximately 40 to 45 degree position from horizontal. The vent door was open. The door emergency power assist system (EPAS) pressure cylinder gauge was not visible due to fire damage. The slide/raft bustle was not attached to the door and the arm/disarm lever was in armed position. A Survival Factors Group member was able to rotate door handle and lift door off its stops in order to release the girt bar and remove the evacuation slide/raft. Following removal of the slide/raft, the door handle was fully rotated to the open position. The door lifted off the door stops and the door emergency power assist system (EPAS) pressure cylinder activated and the door opened. The door hinge and release mechanisms were functional. The door and doorway had fire and soot damage; however, no notable structural damage to door and doorway frame was detected.

Door 2R Evacuation Slide/Raft

Air Cruisers Company

Part number: 62772-216

Serial number: 0704

Date of Manufacture: Nov 2000

The evacuation slide/raft was found deployed (deflated) inside airplane on the door passageway floor through the galley and ending approximately 1 foot short of the left main aisle. The slide/raft was burnt on top with layers underneath protected from the fire. There was a large amount of burnt debris on top of the slide. The girt bar was attached to the floor fittings and was undamaged. The slide/raft packboard was attached to door with minimum thermal damage. The yellow packboard cover material was visible while being surrounded by door linings and monuments which were black from fire and soot damage. The slide/raft's pressure cylinder was empty and the slide/raft bustle was not attached to the door. The bustle sustained thermal damage on both interior and exterior surfaces. Both the cylinder and packboard cover release safety pins were stowed in the safety pin stowage pocket on the packboard cover. The packboard packboard cover release cable/pin was still installed in the packboard packboard cover release mechanism. The girt bar was removed from floor fittings and slide/raft was

removed from the airplane through the door 2L. The 2R slide/raft was shipped to Air Cruisers Company to conduct a teardown examination. (See section 5.0.1)

4.1.5 Door 3L

The door was found in the open position. The door's emergency power assist system (EPAS) pressure cylinder was empty (0 psi). The slide/raft bustle was not attached to the door and the exit arm/disarm lever was in armed position. The door hinge and release mechanisms were functional. There was slight buckling detected at center of both the forward and aft edges of the doorframe. No other notable damage to door or doorframe was detected.

Door 3L Evacuation Slide/Raft

Air Cruisers Company

Part number: 62773-319

Serial number: 0867

Date of Manufacture: not legible of maintenance record card

“Mod per 777 SB 107-25-30”

The uninflated slide/raft was hanging from the girt bar on the door sill and was resting on the ground when investigators arrived. The pressure cylinder was fully charged (within green band). The packboard was attached to the door and the bustle was found on the ground aft of door 3L next to the fuselage at approximately airplane STA 1748. Both the cylinder and packboard cover release safety pins were stowed in the safety pin stowage pocket on the packboard cover. A Survival Factors Group member removed the slide/raft pressure cylinder safety pin from slide packboard stowage pouch and installed into cylinder on 7/7/13 at approximately 1255. The inflation cylinder pressure was later released by United Airlines personnel on 7/9/13. The door 3L slide/raft was shipped to Air Cruisers Company to conduct a teardown examination. (See section 5.0.1)

4.1.6 Door 3R

Door 3R was found in the open position. Damage to the floor structure in the area of the door resulted in the floor being raised approximately 16 inches above the door sill. The door emergency power assist system (EPAS) pressure cylinder was empty (0 psi). The exit arm/disarm lever was in armed position. The door hinge and release mechanisms were functional.

Door 3R Evacuation Slide/Raft

Air Cruisers Company

Part number: 62773-320

Serial number: 0860

Date of Manufacture: Feb 2002

“Inspected/replaced per 777 SB 107-25-25”

“Mod per 777 SB 107-25-30”

The 3R slide/raft was partially deployed when investigators arrived but it had not inflated. The girt bar was attached to the floor fittings and the slide/raft rested on top of the fuselage wreckage that was under the door sill. The pressure cylinder was fully charged (within green band). The packboard was attached to the door. The bustle was not attached to the door was found on the ground behind the trailing edge of the just beyond the wing flap. The top panel of the packboard was bent up in middle. The door bustle was cracked in downward direction on top portion and along top back edge. Both the cylinder and packboard cover release safety pins were stowed in the safety pin stowage pocket on the packboard cover. A Survival Factors Group member removed the pressure cylinder safety pin from slide packboard stowage pouch and installed it into cylinder on 7/7/13. The slide/raft and girt bar was removed from the airplane, unfolded, and examined. All of the slide/raft sequencing restraints were intact and both aspirator Velcro straps attached. No notable damage was identified to the inflatable.

4.1.7 Door 4L

Door 4L separated from the doorframe and was found on the ground outside the airplane approximately 13 feet laterally from the door sill. The exterior of the door was facing up. The vent door was open. The door emergency power assist system (EPAS) pressure cylinder was charged with the gauge in green band. The slide bustle was not attached to exit and was found on runway 28L. The door handle was approximately in the 10 to 15 degree position. The door arm/disarm lever was in armed position. The forward door frame of the door itself was cracked between stops 3 and 4. No crack or obvious buckling was detected in the aft door frame. The door latch and guide rollers were intact and no damage detected on the doorway stops on the edge frame. Both the forward and aft doorway edge frames were cracked between door stops 3 and 4. The lower aft doorway frame was also cracked between stops 6 and 7.

Door 4L Evacuation Slide/Raft

Air Cruisers Company

Part number: 62774-415

Serial number: 0957

Date of Manufacture: Feb 2002

“Mod per 777 SB 107-25-30”

The door 4L slide/raft was found inside the airplane fuselage extending aft. The floor structure under the door sill and aft was missing and the slide/raft was resting on the ground. The girt bar was attached to the floor fittings. The pressure cylinder was empty. The packboard was attached to the door and the bustle was found on runway 28L. Seven of the eight packboard cover retention cables were fractured. Both the cylinder and packboard cover release safety pins were stowed in the safety pin stowage pocket on the packboard cover.

The girt bar was disconnected and the slide/raft was removed from the airplane and examined. The slide/raft was generally still partially from the second main fold

through the toe end of slide/raft. All of the sequencing restraints were intact and the slide/raft had no obvious drag marks. The slide/raft's aft aspirator had ingested a blanket or curtain cabin divider. The forward aspirator had ingested a stack of folded paper towels. Two tears (approximately 1 ½ and 2 ½ inches long) were found on the aft, upper main tube in line with lifeline upper end attachment. The slide packboard and bustle were shipped to Air Cruisers Company for teardown examination. (See section 5.0.1)

4.1.8 Door 4R

Door 4R was open and the door emergency power assist system (EPAS) pressure cylinder was empty (0 psi). The slide/raft packboard and bustle were not attached to the door. The door arm/disarm lever was in armed position. The door hinge and release mechanisms were functional.

Door 4R Evacuation Slide/Raft

Air Cruisers Company

Part number: 62774-424

Serial number: 1281

Date of Manufacture: Apr 2007

No SB identified on girt

The girt bar was attached to the floor fittings. The slide/raft was torn away at girt and the girt as pulled approximately 8 inches aft on the girt bar. The slide/raft was found slightly to the right of airplane centerline at the break in the aft pressure bulkhead, approximately STA 2180, and extended aft away from the airplane. The manual inflation handle was missing and the inflation cable was broken approximately 54 inches from the valve. The pressure cylinder was fully charged with safety pin installed in the valve; however, no warning flag was present on the safety pin. The slide/raft packboard and bustle were not attached to the door. The packboard was found in the aft galley behind the aft lavatory wall and its top latch handle nylon retention clip was broken. The cylinder safety pin warning flag was found in the safety pin stowage pocket on the packboard cover with no pin attached. The packboard cover release pin was also in the safety pin stowage pocket on the packboard cover. The bustle was found inside the airplane approximately 4 feet aft of door 4L under some fuselage wreckage. The 4R slide/raft was shipped to Air Cruisers Company for teardown examination. (See section 5.0.1)

4.2 Flight Attendant Jumpseats and Emergency Equipment

The airplane cabin was equipped with 13 single-seat flight attendant jumpseats that were distributed in the cabin as shown in figure 2. All of the jumpseats were occupied on the accident flight with the exception of the forward-facing jumpseat at door 2R. The location of emergency equipment is also depicted.

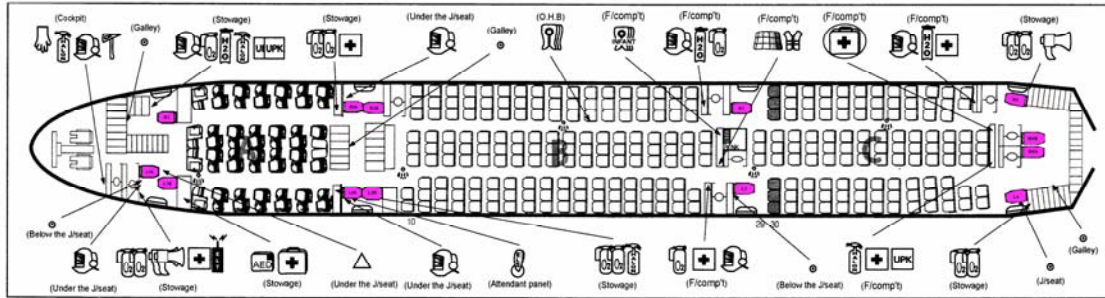


Figure 2. Flight attendant jumpseat and emergency equipment locations.

1L Aft-facing F/A Jumpseat

Goodrich

Part Number (P/N) 2112-711LL

Serial Number (S/N) 8995-2112

DOM: 12/21/05

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: not legible due to minor heat damage

The 1L aft-facing jumpseat had a missing head rest but was fully functional. It was undamaged. The life vest was present but the flashlight was not identified. The four-point restraint was unlatched, undamaged, and functioned normally.

1L Forward-facing F/A Jumpseat

Goodrich

P/N 2112-701LL

S/N 8993-2112

DOM: 12/21/05

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: 09/09

The 1L forward-facing jumpseat was fully functional. There was some smoke damage from a ceiling panel that fell from the above-door ceiling compartment. The above-door ceiling stowage compartment was open about 6 inches. The life vest and flashlight were present but the PBE was not identified. The four-point restraint was unlatched, undamaged, and functioned normally.

1R Forward-facing F/A Jumpseat

Goodrich

P/N 2112-702LL

S/N 8979-2112

DOM: 12/23/05

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: 12/05

The seatpan of the forward-facing jumpseat was twisted in the inboard/down direction. The forward edge of the seatpan was measured to be 18.5" at the outboard corner and 16 1/8" at the inboard corner resulting in a twist of approximately 2 3/8". The seat would not retract on its own. The four-point restraint was unlatched, undamaged, and functioned normally. The flashlight was present and functioned normally

2L Aft-facing Jumpseat

Goodrich

Part # 2112-711LL

Serial # 8982-2112

DOM: 12/21/05

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: 8/09

The aft-facing 2L jumpseat had severe fire damage, the head rest was missing, and it was leaning aft. (The whole partition had partially broken loose from its mountings.) The four-point seatbelt was present, extended, and not functional (no retraction). The lapbelt portion of the restraint was unlatched but could be successfully latched. The emergency equipment compartment at the base of the seat was open and no emergency equipment was present.

2L Forward-facing Jumpseat

Goodrich

Part # 2112-702LL

Serial # 8994-2112

DOM: 12/23/05

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: 10/10

The forward-facing 2L jumpseat was in good condition with no damage. There was no noticeable damage to the seatpan and it retracted correctly. The four-point restraint was unlatched, undamaged, and functioned normally. The life vest and flashlight were present.

2R Aft-facing Jumpseat

The manufacturer, P/N, and S/N information of the 2R aft-facing jumpseat and restraint could not be identified due to extensive fire and thermal damage. The head rest was missing and the seatbelt was burned and melted. The seatpan was retracted and no deformation noted to it. The seat cushion had been consumed by fire. The emergency equipment door at the base of the seat was closed, and a fire-damaged PBE was identified inside. The PBE was manufactured by B/E Aerospace part number 119003-11 in November 2012. The serial number was 004-69813M.

2R Forward-facing Jumpseat

The manufacturer, P/N, and S/N information of the 2R forward-facing jumpseat could not be identified due to extensive fire and thermal damage. The 2R forward-facing flight attendant seat's head rest and upper back cushion were consumed by the fire but the lower back and seatpan cushion were present. The upper seat restraints were consumed by the fire but the lower seat restraints were intact and the seat buckle was functional. The life vest and flashlight were present but the life vest was not in its compartment.

Restraint

Pacific Scientific 4 point

P/N: 1117556-200-225

S/N: None

DOM: 11/05

3L Aft-facing Jumpseat

Goodrich

Part # 2112-702LL

Serial # 9001-2112

The aft-facing 3L jumpseat was not fire damaged. There was no noticeable damage to the seatpan and it retracted correctly. The four-point restraint was unlatched, undamaged, and functioned normally. The emergency equipment compartment was latched and the flashlight and life vest were present inside. The floor was deformed under the jump seat.

3R Aft-facing Jumpseat

Goodrich

Part #2112-702LL

Serial #8978-2112

The seatpan of the 3R aft-facing jumpseat was deformed and bent downward. The four-point restraint was unlatched, undamaged, and functioned normally. The emergency equipment door would not open.

4L Forward-facing Jumpseat

Goodrich

Part # 2112-702LL

Serial # 9009-2112

DOM: 12/23/05

The 4L forward-facing jumpseat was ejected from the airplane and was found to the right of runway 28L centerline, approximately 500 feet from the runway threshold. It remained attached to a section of aft galley and the galley tie rods were sheared at a 45 degree angle. The seat was relatively undamaged and the seatpan retracted normally.

The seatbelt inertia reels functioned normally. The four-point restraint was unlatched, undamaged, and functioned normally. Red stains were noted on head rest and right shoulder restraint. The following information was obtained from the restraint:

Pacific Scientific 4 point (45402)

Duarty, CA

P/N 1117556-100-225

NA 2100002-100-225

FA 2100002-01-225

Date MFG 02/12

Rate STR 2500

FAA TSO C114

4R Forward-facing F/A Jumpseat

Goodrich

P/N 2112-702LL

S/N 9005-2112

Date of Manufacture 12/23/05

TSO C127a

The 4R forward-facing jumpseat was ejected from the airplane was found to the right of runway 28L centerline, approximately 550 feet from the runway threshold. It remained attached to a section of aft galley and the galley tie rods were broken at a 45 degree angle. The galley structure was also fractured at the level of the head rest. The seatpan was deformed and there was abrasion damage on outboard corner of the seatpan. The four-point restraint was unlatched, undamaged, and functioned normally. The following information was obtained from the restraint:

Seatbelt Pacific Scientific 4 point
Duarty, CA
PN 1117556-100-225
NA 2100002-100-225
FA 2100002-01-225
Date MFG 02/12
Rate STR 2500
FAA TSO C114

The 4R jumpseat's flashlight, life vest, and megaphone were missing. The portable oxygen bottles were still in place.

M4A Aft-facing Aft Galley F/A Jumpseat (left side)
Goodrich
Part #2112-701LL
Serial # 8976-2112
DOM 12/23/05
TSO C127a

The M4A jumpseat was found inside the airplane still affixed to the aft lavatory wall in the aft galley. The seatpan was found in the extended position and would not retract automatically; however, it could be closed with force. The four-point restraint was unlatched and the buckle functioned normally. The inertia reels were functional but the outboard lap belt attachment shackle was fractured. The restraint and shackle were submitted to the NTSB Materials Laboratory for analysis and the fracture surface was consistent with combined tension and bending overstress loading. No preexisting fatigue fractures were noted (See attachment 6). The seat's flashlight and life vest were present but the stowage compartment frame was fractured and the cover was missing.

M4B Aft-facing Aft Galley F/A Jumpseat (right side)
Goodrich
P/N 2112- [Unknown]
S/N [Unknown]

The M4B F/A jumpseat (still mounted to a section of aft galley wall) was located approximately 50 feet aft of the aft pressure bulkhead in a grassy area. The seat was attached to a portion of aft lavatory wall. The shoulder cushion was torn. The seatpan retracted automatically. The four-point restraint was latched and both the inertia reels and the buckle functioned normally. The seat's flashlight and life vest were not identified.

4.3 Additional Cabin Emergency Equipment

Below is a summary of the additional emergency equipment shown in figure 2 that was identified in the airplane cabin:

Cockpit

The Kidde Halon 1211 2.5 lb. fire extinguisher (P/N X-059800) was secured in place with the needle in the green band. The crash ax was missing and its securing restraints were open. The portable oxygen bottle was missing but the restraints had been opened. The toolbox inside the closet was in place. The landing gear lock pins were stowed and intact. The gloves were not identified. The cabinet above the closet that was placarded "Emergency Only" contained the PBE. The PBE was secured in place and was damaged by fire.

1L Forward Storage

Honeywell portable ELT (P/N 1095599-1) Exp. 5/22/2017
124 minute portable oxygen bottle (2) (P/N 1271429) (unused but found outside airplane)
Voice Gun megaphones (2) (P/N A12SA)
First Aid Kit (P/N 3241)
Kidde water fire extinguisher (P/N 892480, S/N 22180) Exp. 9/30/1014

1R Forward Storage

Kidde Halon 1211 fire extinguisher (P/N 843707, S/N X-843707)
Water fire extinguisher
B/E Aerospace PBE (P/N 119003-11) Exp. 12/1/2015
Universal precaution kit (2) (P/N NSM0018) Exp. 9/13/2014
Portable oxygen bottle had been removed by UAL mechanics on 7/9/13

Row 1 Storage

All contents destroyed by fire.

Door 2L Storage

All contents destroyed by fire.

Door 2R Storage

All contents destroyed by fire.

Door 3L Storage

All contents destroyed by fire. The doghouse compartment forward of lavatory 3F-1L at door 3L was blocked by floor and not able to be opened.

Door 3R Storage

All contents destroyed by fire.

4L Jumpseat Area

Scott portable oxygen bottle (11 cu. ft.) (2) (P/N 9700-G2A-BF-10A) Exp. 10/4/2017 and 9/14/2016

The doghouse compartment forward of aft center lavatory near door 4L was crushed by seat row 42 DEG moving aft on top of it. The door was missing and the outboard insert was pulled out. The first aid kit (P/N 3241) was present. The UPK was present. A

Kidde Halon 1211 fire extinguisher P/N X-8980052, S/N X-059922 was present. All were undamaged.

4R Jumpseat Area

Scott portable oxygen bottle (11 cu. ft.) (2) (P/N 9700-G2A-BF-10A) Exp. 12/9/2017 and 9/31/2013

Voice Gun megaphone (P/N A12SA)

Kidde Halon 1211 fire extinguisher (P/N X-8980052, S/N X-059710) Exp. 11/30/2017

The doghouse compartment forward of aft center lavatory near door 4R (aft of seat 41J) was closed and latched. The First Aid Kit (P/N 3241)), a Kidde water fire extinguisher (P/N 892480, S/N OZ105, Exp. 7/24/2015), a BE Aerospace Portable Breathing Equipment (PBE) (P/N 119003-11, Exp. 9/13/2015), and a life vest were located in this compartment. They were undamaged. The life vest was not labeled on the outside of the door. No placard was identified. The bottom portion of the PBE case was broken.

The doghouse compartment forward of the aft center lavatory at Door 4R was closed and latched and the Emergency Medical Kit (EMK) (S/N 59) was the only item inside. It was undamaged.

Crew Rest

A Halon fire extinguisher, water fire extinguisher, and oxygen bottle were all identified and secured in place. The oxygen masks were deployed

Miscellaneous

A crew PBE was found still in its container at 6A. An open crew PBE was found outside the airplane at the bottom of the 1L slide/raft.

4.4 Cockpit Seats

The captain's and first officer's seats were both attached to their respective seat tracks. The captain's seat was undamaged except the left thigh support was missing and appeared to be sheared. The shoulder harness inertia reels were not functional. There was no damage to the restraint webbing and the buckle was unlatched and functional.

The first officer's seat was undamaged with the exception of the left armrest which was bent inboard 30 degrees. The shoulder harness inertia reels functioned normally. There was no damage to the restraint webbing and the buckle was unlatched and functional.

Both observers' seats were undamaged. There was no damage to the 5-point restraints (with rotary buckle). The oxygen mask was deployed at the observer seat.

The following information was obtained from the data plates on the cockpit seats:

Captain Seat

Ipeco

P/N 3A258-0041-01-1

S/N 43398

Model # 0A 258-0043

Date of Manufacture 12/05/05

TSO C127a Type A Approval Conditions

Captain Shoulder Harness

AmSafe

PNR 5000-1-01A-2396

MFR 35FB9

DMF RA0309

ASSY: 5000-20301A2396

SN 05Oct06-2

M/ numb 501300-11

Conformed to: FAA TSO-C114

CAA AR-34

Rated 3000 lbs

Captain Lap Belt

AmSafe

Part No: 5000-1-01A-2396

Manufacture No: 35FB9 DMF-R-A0309

ASSY: S7A5000-20301A2395

S/N 05 OCT 06-2

Captain Seat Bottom Cushion

IPECO

PART # 0A254-0209

Date June 2008 BL Batch No: WS0816-8C

Captain Seat Back Cushion

IPECO

PART # 0A254-0511

Date April 2005 BL Batch No: 0029197-4A

TSO -C127a Type A-FF

Vauth and Sohn GmbH

Serial No: 10490 Batch No: WS0816

MFCT: -WO 2080162-5

Hardness: 621, 41 N.

First Officer Seat

Ipeco

P/N: 3A258-0042-01-1

S/N: 36767

Model # 0A 258-0044
DOM: 02/05/01
TSO C127a
Restraint: 5-point AmSafe
Assy# Unreadable due to wear and smoke
S/N: Unreadable

1st Observer Seat (Center)

4/Flight
P/N: 16800-1
S/N: 92873
DOM 6/05
9G fwd, 4.1G up, 9.1G down, 4.0G side, 1.5G aft
TSO-C127

2nd Observer Seat

4/Flight
P/N: 16810-1
S/N: 96958
DOM: 1/06
9G fwd, 4.1g up, 9.1g down, 4.0g side, 1.5g aft
TSO-C127

4.5 Cabin Seats

A-zone Business Class Cabin

The A-zone seats were Sogerma Solstys (TSO-C127a approved) business class seats installed by JAMCO via Supplemental Type Certificate (STC) ST01889SE-D. There were two versions of the single seat units (LH and RH) which resulted in a staggered 4-across seating configuration. The left-side single window seats were designated A, while the right side single window seats were designated K. Two seats in the mid-cabin area were designated E and F in odd numbered rows and D and G in even numbered rows. Information obtained from seats' data plates indicated the LH seat part number was FJPL4-01A201-03 while the RH seat part number was FJPL4-01A201-04.

The A-zone business class cabin was located between stations 403 and 720 and consisted of 24 business class seats and was heavily damaged by the post-crash fire. The fire damage in A-zone was slightly less on the right hand of the airplane - the K seats were generally the most intact.

The 1A seat had severe fire damage. The seat structure was consumed by the fire.

The 1E seat was consumed by the fire. The 1F seat had heavy fire damage. The seatback structure was present and heavily damaged by the fire. Some of the seatbelt was present. The seat cushions were present and damaged by the fire.

The 1K seat had moderate fire damage. The seatback structure was present and damaged by fire. All of the seat cushions were present and damaged by the fire. The 1K seatbelts were present and unlatched. The 1K seatpan was intact with slight fire damage. The 1K seat appeared to be attached to the floor.

The 2A seat had severe fire damage. The seatback structure was present and heavily damaged by fire. All of the seat cushions were consumed by the fire. The 2B seatbelts were not observed. The right seatbelt fitting was intact with heavy fire damage. The 2B seatpan was severely damaged by fire. The 2A seat appeared to be attached to the floor.

The 2DG seats had severe fire damage with most the damage to the 2D seat. The 2D seatback structure was partially consumed by the fire. The 2G seatback was present and damaged by the fire. The 2D seat cushions were consumed by the fire. The 2G seatback cushions were present and damaged by the fire. The 2G seat bottom cushion was present and damaged by the fire. The 2DG seats appeared to be attached to the floor.

The 2K seat had heavy fire damage. The seatback structure was present and heavily damaged by fire. The 2K seatback cushion was severely damaged by the fire. The 2K seat bottom cushion was intact and moderately damaged by fire. The 2K seatbelts were not observed. The 2K seatpan was intact. The 2K seat appeared to be attached to the floor.

The 3A seat had severe fire damage. The seatback structure was present and heavily damaged by fire. All of the seat cushions were consumed by the fire. The 3A seatbelts were not observed. The right seatbelt fitting was intact with heavy fire damage. The 3A seatpan was severely damaged by fire. The 3A seat appeared to be attached to the floor.

The 3EF seats had severe fire damage. The 3EF seat structure was mostly consumed by the fire. The 3EF seat cushions were consumed by the fire. The 3F seat belt attachment fittings were present and damaged by fire. The 3EF seatpans were present and damaged by fire. The 3EF seats appeared to be attached to the floor.

The 3K seat had severe fire damage. The 3K seat bottom cushion was intact and severely damaged by fire. The 3K seatbelts were present and severely damaged by fire. The 3K seatpan was not observed. The 3K seat appeared to be attached to the floor.

The 4A seat had heavy fire damage. The seatback structure was present and heavily damaged by fire. All of the seat cushions were present and heavily damaged by the fire. The 4A seatbelts were not observed. The 4A seatbelt fitting were intact with heavy fire damage. The 4A seatpan was damaged by fire. The 4A seat appeared to be attached to the floor.

The 4DG seats had severe fire damage with most of the damage to the 4D seat. The 4D seatback structure was consumed by the fire. The 4G seatback was present and damaged by the fire. The 4D seat cushions were consumed by the fire. The 4G seatback cushions were present and damaged by the fire. The 4G seat bottom cushion was present and damaged by the fire. The 4D seatpan was consumed by the fire. The 4G seatpan was present. The 4DG seats appeared to be attached to the floor.

The 4K seat had heavy fire damage. The seatback structure was present and heavily damaged by fire. The 4K seatback cushion was consumed by the fire. The 4K seat bottom cushion was intact and heavily damaged by fire. The 4K seatbelts were not observed. The 4K seatpan was intact. The 4K seat appeared to be attached to the floor.

The 5A seat had severe fire damage. The seat structure was consumed by the fire.

The 5EF seats had severe fire damage with most the damage to the 5E seat. The 5E seatback structure was consumed by the fire. The 5F seatback was present and heavily damaged by the fire. The 5E seat cushions were consumed by the fire. The 5F seatback cushions were present and heavily damaged by the fire. The 5F seat bottom cushion was present and damaged by the fire. The 5E seatpan was consumed by the fire. The 5F seatpan was present and damaged by the fire. The 5EF seats appeared to be attached to the floor.

The 5K seat had heavy fire damage. The seatback structure was present and damaged by fire. The 5K seatback cushion was present and damaged by the fire. The 5K seat bottom cushion was intact and heavily damaged by fire. The 5K seatbelts were not observed. The 5K seatpan was intact. The 5K seat appeared to be attached to the floor.

The 6A seat had severe fire damage. The seatback structure was present and severely damaged by fire. All of the seat cushions were consumed by the fire. The 6A seatbelts were not observed. The 6A seatpan was consumed by fire. The 6A seat appeared to be attached to the floor.

The 6DG seats had severe fire damage. The 6DG seatbacks were present and damaged by the fire. The 6D seatbelt attachment fittings were present and heavily damaged by the fire. The 6G seatbelt attachment fittings were not observed. The 6DG seat cushions were consumed by the fire. The 6D seatpan was consumed by the fire. The 6G seatpan was present and heavily damaged by the fire. The 6DG seats appeared to be attached to the floor.

The 6K seat had heavy fire damage. The seatback structure was present and severely damaged by fire. The 6K seatback cushion was not observed. The 6K seat bottom cushion was intact and heavily damaged by fire. The 6K seatbelts were not observed. The 6K seatpan was intact. The 6K seat appeared to be attached to the floor.

B-zone Economy Class Cabin

The B-zone (and C-zone) seats were Weber Airplane model 5150-3 (TSO-C127a) seats. The following information was obtained from one of the seat's data plates and was representative of all of the seats in B-zone and C-zone.

Weber Airplane LP
2000 Weber Drive
Gainesville, Texas 76240
Weber Model No: 5150-3
Weber P/N 857098-402-00A
Serial Number 53
Modified to 857101-401-01A
Modified by WAC
Date of Modification 01-06
Meets FAA TSO-C127a, Type A, FWD Facing
Notice: See Weber Drawing 857881 for FAR 25, AMDT 25-64 for installation limitations. Complies with AS8049a
TSO Seat with optional equipment installed in accordance with Weber integration drawing 857367
Seats continue to comply with TSO as shown in seat TSO label
Approved Bottom Cushion: 852696-411

Seatbelt Information
AMSAFE P/Ns
LH: 504377-411-8062
RH: 504377-412-8062

The B-zone economy class cabin was located between stations 830 and 1460. B-zone consisted of 157 economy seats. The general seating arrangement consisted of triple seats installed on left side of airplane identified as seats ABC, center as DEG, and right side as HJK. The first and last row on the left side of the airplane were double economy seats identified as seats 10AB and 28AB, respectively.

The B-zone economy class cabin was heavily damaged in the post-crash fire. There was localized floor buckling at seat row 15. The fire appeared to be most severe on the left side of the cabin with the forward right side of the area receiving the least severe fire damage. A description of damage to individual seats units can be found following a list of the overall B-zone seat observations:

- All of the seats were damaged or consumed by fire.
- Most of the seats appeared to be attached to the seat tracks except the center and right hand side seats at row 15.
- The general condition of the B-zone seat legs appeared to have similar or slightly less bending that what was observed in C-zone. Only two seat legs were found cracked or broken.

The 10AB seats had significant fire damage. The seatbacks were consumed by the fire. The seat cross tubes were intact with no apparent structural damage. The 10AB seatpan was consumed by fire. The seat cushions were present. No damage was noted to the armrests. The seat track fittings were attached to the floor.

The 10DEG seats had moderate fire damage with burn marks and scorching on the seat cushions with most of the damage on the 10G seat. The 10DE seatbelt fittings were present. The 10G seatbelts were unobserved due to the fire damage. The seatback cushions in 10DE had scorch marks and burn holes. The 10G seatback cushion was heavily damaged by fire. The seat bottom cushions in 10DE had scorch marks and burn holes. The 10G seat bottom cushion was heavily damaged by fire. The 10DEG seatpans appeared normal. The 10DE arm rests appeared normal. The 10G arm rest was damaged by fire. The 10DEG seat legs were all bent left. The 10DEG left aft leg was bent left into an “S” shape. The seat track fittings were attached to the floor.

The 10HJK seats had some light fire damage with burn marks and scorching on the seat cushions with most of the damage on the 10H seat. The 10HJK seatbelts and fittings were present. The seatback cushions in 10JK had small scorch marks and burn holes. The 10H seatback cushion was damaged by fire. The seat bottom cushions in 10JK had little to no scorch marks and burn holes. The 10H seat bottom cushion was heavily damaged by fire. The 10HJK seatpans appeared normal. The 10JK arm rests appeared normal. The 10H arm rest was damaged by fire. The 10HJK seat legs were bent left with the right aft seat leg bent into an “S” shape. The seat track fittings were attached to the floor.

The 11ABC seats had significant fire damage with the heaviest damage to the 11A seat. All the seatbacks were consumed by the fire. The 11C aisle side seatbelt fittings were present. The 11A aft seat cross tube was bent from fire damage. The 11A seatpan and cushion was consumed by the fire. The 11BC seat cushions were present. The 11AB arm rest as consumed by the fire. The 11BC arm rest was heavily damaged by fire and bent inboard. The seat track fittings were attached to the floor.

The 11DEG seats had fire damage with large burn marks and scorching on the seat cushions. The 11DEG seatbelt fittings were present. The seatback cushions in 11DE had large burn marks and burn holes. The 11G seatback cushion was heavily damaged by fire. The 11E seatback tray was out. The seat bottom cushions in 11DE had scorch marks and burn holes. The 11G seat bottom cushion was heavily damaged by fire. The 11DEG seatpans appeared normal. The 11DEG arm rests had some heat and fire damage. The 11D left arm rest was bent left. The 11DEG seat legs were all bent left. The seat track fittings were attached to the floor.

The 11HJK seats had some light fire damage with burn marks and scorching on the seat cushions. The 11HJK seatbelts and fittings were present. The seatback cushions in 11HJK had small scorch marks and burn holes. The 11K seatback tray was out. The seat bottom cushions in 11HJK had some scorch marks and burn holes. The 11HJK seatpans appeared normal. The 11HJK arm rests appeared normal with some heat

damage. The 11HJK seat legs were bent left with the right aft seat leg bent into an “S” shape. The seat track fittings were attached to the floor.

The 12ABC seats had significant fire damage with most of the seat structure consumed by the fire. All the seatbacks were consumed by the fire. The 12A seat was completely consumed by the fire. The 12BC seat cushions were consumed by the fire. The 12BC cross tubes and some seatpan pieces remained. The 12ABC arm rests as consumed by the fire. The 12BC seat track fittings were attached to the floor.

The 12DEG seats had fire damage with large burn marks and scorching on the seat cushions with the most damage to the 12E seat. The 12D and 12G seatbelts were present. 12E seatbelt fittings were not observed due to the fire. The seatback cushions in 12DE had large burn marks and burn holes. The 12G seatback cushion was lightly damaged by fire. The 12G seatback tray was out. The seat bottom cushions in 12D and 12G had scorch marks and burn holes. The 12E seat bottom cushion and seatpan was heavily damaged by fire. The 12D and 12G seatpans appeared normal. The 12DEG arm rests had some heat and fire damage. The 12DEG seat legs were all bent left with fire damage to the front legs. The seat track fittings were attached to the floor.

The 12HJK seats had fire damage with burn marks and scorching on the seat cushion. The 12K seatbelt was present with fire damage. The 12HJ seatbelts were not observed. The seatback cushions in 12HJK had fire damage with burn marks and large areas of scorching. The seat bottom cushions in 12HJK had scorch marks and burn holes. The 12HJK seatpans and cross tubes appeared normal. The 12HJK arm rests had some heat and fire damage. The 12HJK seat legs were all bent left. The seat track fittings were attached to the floor.

[There was no row 13 designated on the airplane.]

The 14ABC through 19ABC seats were completely consumed by the post-crash fire.

The 14DEG seats had moderate fire damage with heat and fire damage to all of the seats. The 14D seatbelt was present. 14EG seatbelts were not observed due to the fire. The 14DE seatback cushions were heavily damaged by fire. The 14G seatback was damaged by the fire. The 14DEG seat bottom cushions were scorched by the fire. The 14DEG seatpans appeared normal. The 14DEG arm rests had heavy heat and fire damage. The 14DEG seat aft legs were all bent left. The 14DEG right forward leg was unattached. The remaining seat track fittings were attached to floor. The floor panels aft of the seat sloped up due to buckling in the floor panel.

The 14HJK seats had fire damage with burn marks and scorching on the seat cushions. The 14H seatbelt was present with fire damage. The 14JK seatbelts were not observed. The 14HJ seatback trays were out. The seatback cushions in 14HJK had fire damage with burn marks and large areas of scorching. The seat bottom cushions in 14HJK had scorch marks and burn holes. The 14HJK seatpans and cross tubes appeared

normal. The 14HJK arm rests had some heat and fire damage. The 14HJK seat legs were all bent left. The seat track fittings were attached to the floor.

The 15DEG seats had heavy fire damage and were tipped back with the forward legs unattached to the seat track. 15DEG seatbelt fittings were not observed due to the fire. The 15DEG seatbacks were heavily damaged by the fire. The 15DE head rests were consumed by the fire. The 15DEG seatback cushions were heavily damaged by fire. The 15DEG seat bottom cushions were lightly damaged by fire. The 15DEG seatpans appeared normal. The 15DEG arm rests had heavy fire damage. The 15DEG center seat forward legs were not attached to the seat track. The floor was buckled in the area of the 15DEG seat legs. The left forward seat leg was bent left. The seat track behind the right aft leg was broken.

The 15HJK seats were tilted back with heavy fire damage to the 15JK seat cushions. The 15H seatbelt was present with fire damage. The 15JK seatbelts were not observed. The 15HJK seatback cushions had heavy fire damage. The 15H seat bottom cushion had scorch marks and burn holes. The 15JK seat bottom cushions were heavily damaged. The 15HJK cross tubes appeared normal. The 15H seatpan appeared normal. The 15JK seatpans had fire damage. The 15H aisle side arm rests appeared normal. The 15JK arm rests had heat and fire damage. The aft left leg was bent into an “S” shape with cracking at the lower bend. The forward left leg was bent left. The aft right leg was bent left. The forward right leg was not attached. The remaining seat track fittings were attached to the floor. The floor panel was bulged up.

The 16DEG seats had heavy fire damage with the seatbacks consumed by fire. The 16DEG seatbacks were consumed by the fire. The 16G seat bottom cushion heavily damaged by the fire. The 16DE seat bottom cushions were consumed by the fire. The 16G right hand arm rests was heavily damaged by fire and bent left. The seatpans were heavily damaged by the fire. The seat legs were bent left. The seat track fittings were attached to the floor.

The 16HJK seats had moderate fire damage with large burn marks and scorching on the seat cushions. The 16HJK seatbelts were not observed. The 16H seatback tray was out. The seatback cushions in 16HJK had fire damage with burn marks and large areas of scorching. The seat bottom cushions in 16HJK were damaged by the fire. The 16HJK seatpans and cross tubes appeared normal. The 16HJK arm rests had heat and fire damage. The 16HJK seat legs were all bent left. The seat track fittings were attached to the floor.

The 17DEG seats had heavy fire damage with much of the seats consumed by fire. The 17DEG seatbacks were consumed by the fire. The 17DEG seatpans were partially consumed by the fire. The front cross tubes were broken from fire. The 17E arm rests were consumed by fire. The 17D and 17G aisle arm rests were severely damaged by the fire. The seat legs were bent left. The seat track fittings were attached to floor.

The 17HJK seats had moderate fire damage with much of the seatback cushions damaged by the fire. The 17HJK seatbelts were not observed. The 17K seatback tray was out. The 17HJK seatback cushions had heavy fire damage. The 17HJK seat bottom cushions were heavily damaged by the fire. The 17HJK seatpans and cross tubes appeared normal. The 17HJK arm rests had heat and fire damage. The 17H aisle arm rest was bent to the left. The 17HJK seat legs were all bent left. The seat track fittings were attached to the floor.

The 18DEG seats had severe fire damage with much of the seats consumed by fire. The 18DEG seatbacks were consumed by the fire. The 18DEG seatpans were partially consumed by the fire. The 18DEG arm rests were partially consumed by fire. The seat track fittings were attached to the floor.

The 18HJK seats had moderate fire damage with much of the seatback cushions damaged by the fire. The 18HJK seatbelts were not observed. The 18JK seatback trays were out. The 18HJK seatback cushions had heavy fire damage. The 18HJK seat bottom cushions were heavily damaged by the fire. The 18HJK seatpans and cross tubes appeared normal. The 18HJK arm rests had heat and fire damage. The 18HJK seat legs were all bent left. The seat track fittings were attached to the floor.

The 19DEG seats had severe fire damage with much of the seats consumed by fire. The 19DEG seatbacks were consumed by the fire. The 19DEG seatpans were partially consumed by the fire. The 19DEG arm rests were consumed by fire. The left seat legs were bent left. The seat track fittings were attached to the floor.

The 19HJK seats had moderate fire damage with much of the seatback cushions damaged by the fire. The 19HJK seatbelts were not observed. The 19HJ seatback trays were out. The 19HJK seatback cushions had heavy fire damage. The 19HJK seat bottom cushions were heavily damaged by the fire. The 19HJK seatpans and cross tubes appeared normal. The 19HJK arm rests had heat and fire damage. The 19HJK seat legs were all bent left. The seat track fittings were attached to the floor.

The 20ABC seats had significant fire damage with the heaviest damage to the 20C seat. The 20C seatback was consumed by the fire. The 20AB seatback cushions were present but heavily damaged by fire. The 20ABC seat cushions were present. The 20A and 20C arm rests were damaged by the fire. The seat legs were bent outboard. The aisle side leg was bent more than the window side leg. The seat track fittings were attached to the floor. The luggage bar was damaged by the fire.

The 20DEG seats had severe fire damage with most of the seats consumed by fire. The 20DEG seatbacks were consumed by the fire. The 20DEG seatpans were consumed by the fire. The 20DEG arm rests were consumed by fire. The seat track fittings were attached to the floor.

The 20HJK seats had heavy fire damage with much of the 20JK seatbacks consumed by the fire. The 20HJK seatbelts were not observed. The 20H seatback had

heavy fire damage. The 20JK seatbacks were consumed by the fire. The 20H seat bottom cushion was heavily damaged by the fire. The 20JK seat bottom cushions were consumed by the fire. The 20H seatpan and cross tubes appeared normal. The cross tube was heavily damaged at 20JK. The 20H arm rests had heavy fire damage. The 20JK arm rest were consumed by the fire. The 20HJK seat right legs were all bent left. The 20HJK seat left legs were consumed by the fire. The seat track fittings were attached to the floor.

The 21ABC seats had significant fire damage with the heaviest damage to the 21B and 21C seat. Part of the 21B seatback and all of the 21C seatback was consumed by the fire. The 21ABC seatpans structurally appeared normal. The 21C arm rests was consumed by the fire. The rear seat legs were bent outboard. The forward legs were straight or unobserved. The seat track fittings were attached to the floor.

The 21DEG seats had severe fire damage with most of the seats consumed by fire. Very little of the seats remained. The seat track fittings were attached to the floor.

The 21HJK seats had heavy fire damage with much of the 21JK seatbacks consumed by the fire. The 21HJK seatbelts were not observed. The 21H seatback had heavy fire damage. The 20JK seatbacks were consumed by the fire. The 21H seat bottom cushion was heavily damaged by the fire. The 21JK seat bottom cushions were consumed by the fire. The 21H seatpan and cross tubes appeared normal. The cross tube was heavily damaged at 21J and consumed at 21K. The 21H arm rests had heavy fire damage. The 21JK arm rest were consumed by the fire. The 21HJK seat right legs were all bent left. The 21HJK seat left legs were consumed by the fire. The seat track fittings were attached to the floor.

The 22ABC seats had heavy fire damage. The 22ABC seatbacks were consumed by the fire. The 22C aisle arm rest was consumed by the fire. The 22BC arm rest was heavily damaged by the fire. The seatpans were heavily damaged by the fire. The seat legs were bent left. The seat track fittings were attached to the floor.

The 22DEG seats had severe fire damage with much of the seats consumed by fire. The 22DEG seatbacks were consumed by the fire. The 22DEG seatpans were partially consumed by the fire. The 22DEG arm rests were consumed by fire. The left seat legs were bent left. The seat track fittings were attached to the floor.

The 22HJK seats had severe fire damage with the 22JK seats consumed by the fire. The 22HJK seatbelts were not observed. The 22H seatback had heavy fire damage. The 20JK seatbacks were consumed by the fire. The 22H seat bottom cushion was heavily damaged by the fire. The 22JK seat bottom cushions were consumed by the fire. The 22H seatpan and cross tubes appeared normal. The cross tube consumed at 22JK. The 22H arm rests had heavy fire damage. The 22JK arm rest were consumed by the fire. The 22HJK seat left legs were consumed by the fire. The 22HJK seat right legs were bent left and attached to the floor.

The 23ABC seats had heavy fire damage. The 23ABC seatbacks were consumed by the fire. The 23C aisle seat was half consumed by the fire. The 23ABC arm rests were heavily damaged by the fire with the aisle arm rest completely consumed. The seatpans were heavily damaged by the fire. The left seat legs were bent to the left. The seat track fittings were attached to the floor.

The 23DEG seats had severe fire damage with much of the seats consumed by fire. The 23DEG seatbacks were consumed by the fire. The 23DEG seatpans were partially consumed by the fire. The 23DEG cross tubes were intact. The 23DEG arm rests were consumed by fire. The left seat legs were bent left with the left aft seat leg bent into an “S” shape. The seat track fittings were attached to the floor.

The 23HJK seats had severe fire damage with the 23K seats consumed by the fire. The 23HJK seatbelts were not observed. The 23H seatback cushion had severe fire damage. The 23J seatback was burned to the frame by the fire. The 23K seat back was consumed by the fire. The 20H seat bottom cushion was heavily damaged by the fire. The 23JK seat bottom cushions were consumed by the fire. The 23H seatpan and cross tubes appeared normal. The 23J seatpan and cross tubes were damaged by the fire. The seatpan and cross tube were consumed at 23K. The 23H arm rests had severe fire damage. The 23JK arm rest were consumed by the fire. The 23HJK seat left legs were consumed by the fire. The 23HJK seat right legs were bent left and attached to the floor.

The 24ABC seats had heavy fire damage. The 24ABC seatbacks were consumed by the fire. The 24C aisle seat was half consumed by the fire. The 24ABC arm rests were heavily damaged by the fire with the aisle arm rest completely consumed. The seatpans were heavily damaged by the fire with most of the seat cushions consumed by the fire. The left seat legs were bent left. The aft right leg was bent to the left in an “S” shape. The forward right set leg was bent to the left. The seat track fittings were attached to the floor.

The 24DEG seats had heavy fire damage with much of the seatbacks consumed by fire. The 24DEG seatbacks were severely damaged by the fire with some of the frame remaining. The 24DEG seatpans were intact. The 24DEG cross tubes were intact. The 24DEG arm rests were consumed by fire. The left seat legs were bent left with the aft seat legs more than the front. The seat track fittings were attached to the floor.

The 24HJK right side seats had heavy fire damage with much of the seatbacks consumed by fire. The 24HJK seatbacks were severely damaged by the fire with some of the frame remaining. The 24HJK seatpans were intact. The 24HJK cross tubes were intact. The 24HJK arm rests were consumed by fire. The left seat legs were bent left with the aft left seat leg bent into an “S” shape. The seat track fittings were attached to the floor.

The 25ABC seats had heavy fire damage. The 25ABC seatbacks were consumed by the fire. The 25C aisle seat was half consumed by the fire. The 25ABC arm rests were heavily damaged by the fire with both 25C arm rests completely consumed. The

seatpans were heavily damaged by the fire. The seat legs were bent left with the most bending on the 25BC leg. The seat track fittings were attached to the floor.

The 25DEG seats had heavy fire damage with much of the seats consumed by fire. The 25DEG seatbacks were consumed by the fire. The 25DEG seatpans were consumed by the fire. The 25DEG aft cross tubes were consumed by fire and the forward cross tubes were intact with fire damage. The 25DEG arm rests were mostly consumed by fire. The seat track fittings did not appear to be attached to the floor.

The 25HJK seats had heavy fire damage with much of the seatbacks consumed by fire. The 25HJK seatbacks were severely damaged by the fire with very little of the frames remaining. The 25HJK seatpans were intact with fire damage. The 25HJK cross tubes were intact with fire damage. The 25HJK arm rests were consumed by fire. The 25HJK seat aft left leg was fractured. The 25HJK seat forward left leg was bent. The seat track fittings were attached to the floor.

The 26ABC seats had heavy fire damage. The 26ABC seatbacks were consumed by the fire. All of the 26ABC arm rest were consumed by the fire but 26A. The seatpans were heavily damaged by the fire. The 26ABC right seat legs were bent left with the most bending on the aft leg. The left seat legs appeared straight. The seat track fittings were attached to floor.

The 26DEG and 27 DEG seats were completely consumed by the post-crash fire. A melted mass of metal was all that remained.

The 26HJK and 27HJK seats were completely consumed by the post-crash fire. A melted mass of metal was all that remained.

The 27ABC seats had significant fire damage with the heaviest damage to the 27C seat. The 27C seatback was consumed by the fire. The 27AB seatback cushions were present but heavily damaged by fire. The 27ABC seat cushions were present and the seatpans appeared normal. Both 27C arm rests were consumed by the fire. The seat legs were bent slightly left. The seat track fittings were attached to the floor.

The 28AB seats had fire damage. The seatbacks were present. The 28AB seatpans appeared normal. The seat cushions were present. No damage was noted to the armrests. The seat track fittings were attached to the floor. The floor was displaced several inches down.

The 28DEG seats had heavy fire damage with much of the seatbacks consumed by fire. The 28G seatback was consumed by the fire. The 28E seatback was severely damaged by the fire with some of the frame remaining. The 28D seatback was intact. The 28EG seatpans were consumed by fire. The 28D seatpan was intact. The 28DEG cross tubes were intact but heavily damaged by fire. The 28EG arm rests were consumed by fire. The 28D arm rest was heavily damage by the fire. The 28EG seat legs were consumed in the fire. The 28D seat track fittings were attached to the floor.

C-zone Economy Class Cabin

The C-zone economy class cabin was located between stations 1510 and 2008. C-zone consisted of 114 economy seats. The general seating arrangement consisted of triple seats installed on left side of airplane identified as seats ABC, center as DEG, and right side as HJK. The last two rows on the left and the last row on the right side of the airplane were double economy seats identified as seats AB and JK, respectively.

The C-zone economy class cabin was heavily damaged in the crash sequence. The post-crash fire did not damage C-zone. The damage to the cabin appeared to be most severe aft of seat row 36. The aft most floor panels appeared to be lying directly on the ground. A description of damage to individual seats units can be found below a list of overall C-zone seat observations:

- All of seats were still intact as a unit and undamaged by fire.
- The seat tracks were intact and attached to the floor panels.
- Many of the seats were rotated aft.
- All of the seatbelts were intact, undamaged, and unbuckled except for seat 42B, where the seatbelt was still buckled.
- The seat tubes were all intact at their junctions to the seat legs. The forward seat cross tubes at seats 41ABC and 42AB were fractured at the right end of the tube.
- The observed seats legs retained at least one seat track attachment point except seats 30HJK, 39ABC, and 41AB. The general condition of the C-zone seat legs had similar or worse bending compared to the seat legs in B-zone. Several aft seat legs were broken.

The 29DEG seatbacks were bent back with the seat 29G seatback piston bent. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to the floor. The seat legs were bent to the left.

The 30ABC seats had rotated aft slightly as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. Seatpan 30A was bent downward. The forward seat track fittings were detached to floor and the seat legs were bent to the left.

The 30DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. The forward seat track fittings were detached from the floor. The aft seat legs were bent to the left.

The 30HJK seats rotated aft as a unit onto row 31. There was no significant damage to the seatbacks and the tray tables were stowed in the armrests. The tray table on the back of seat 30H was broken off. No damage was noted to the seat cushions, cross tube, or armrests. Seat 30J seatpan cross member support was fractured. All legs are

detached from the floor. Both forward and the aft right seat track fittings were detached from the floor. The aft seat legs were severely bent to the left and the aft left leg was fractured. The baggage bar was bent and broken beneath seat 30H.

The 31ABC seats had rotated aft slightly as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. The forward right seat track fitting was detached to floor.

The 31DEG seats were rotated aft and twisted upward toward right side of aircraft. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down. The forward seat track fittings were detached from the floor. The aft seat legs were bent to the left and the aft right leg was fractured.

The 31HJK seats rotated aft as a unit facing the ceiling. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. Seat 31J seatpan was detached from the seat. The forward seat track fittings were detached from the floor. The forward legs were slightly bent to the left and the aft seat legs were severely bent to the left. The aft left leg was fractured. The video monitor screen on the back of the seatback was cracked.

The 32ABC seats had rotated aft slightly as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. Both the forward and aft right seat track fittings were detached to floor.

The 32DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down. The forward seat track fittings were detached from the floor. The aft seat legs were bent to the left and the aft right leg was fractured.

The 32HJK seats rotated aft as a unit onto row 33. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, or cross tube. The armrest left side of seat 32J was bent. The forward seat track fittings were detached from the floor. There was red fluid staining on top of the seatback and monitors of seats 32J and 32K.

The 33ABC seats had rotated aft slightly as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to floor. The aft seat legs were bent to the left. The aft left leg was severely bent and fractured in two places.

The 33DEG seats rotated aft as a unit onto row 34. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 33HJK seats rotated aft as a unit onto row 34. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrest. The forward seat track fittings were detached from the floor.

The 34ABC seats were in the upright position. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to floor. The aft seat legs were bent to the left.

The 34DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpans, cross tube, or armrests. Both forward and the aft right seat track fitting were detached from the floor. The seat legs were bent to the left.

The 34HJK seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrest. The forward seat track fittings were detached from the floor. The aft left leg was bent left and fractured.

The 35ABC seats were in the upright position. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to floor. The aft seat legs were slightly bent to the left.

The 35DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down with 35D and 35G pans detached from seat. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 35HJK seats rotated aft as a unit onto row 36. There was no significant damage to the seatbacks. No damage was noted to the seat cushions or cross tube. The 35H seatpan was detached from the seat. The armrest left of seats 35K and 35J were bent left and fractured.

The 36ABC seats were in the upright position. Seatback at seat 36A was fractured and completely reclined back onto seat 37A. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to floor. The aft seat legs were slightly bent to the left.

The 36DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 36HJK seats rotated aft as a unit onto row 37. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or

armrest. The front seatpan clip at seat 36J was fractured. The forward seat track fittings were detached from the floor.

The 37ABC seats were bent back with seat 37A fractured and reclined. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. All seat track fittings were attached to floor. The aft seat legs were severely bent to the left.

The 37DEG seats were in the upright position. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 37HJK seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions or cross tube. The seatpans were bent downward. The armrest left of 37J was bent and fractured and armrest left of 37H was fracture in the upward direction. The forward seat track fittings were detached from the floor. The aft legs were bent to the left and fractured.

The 38ABC seats rotated aft laying on the seatbacks facing the ceiling. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. Forward seat track fittings were detached from floor. The aft seat legs were bent to the left.

The 38DEG seats rotated aft as a unit. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down and detached. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 38HJK seats rotated aft as a unit with seatback facing the ceiling. Seat 38H head rest was under seat 39H seat bottom. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrest. The seatpans were bent downward and 38J seatpan was fractured. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 39ABC seats rotated aft laying on the seatbacks facing the ceiling. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. Seat 39B front seatpan cross member was bent downward. All seat track fittings were detached from floor. The seat legs were severely bent to the left.

The 39DEG seatbacks rotated aft. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. All three seatpans were bent down and detached. The forward seat track fittings were detached from the floor. The seat legs were bent to the left.

The 39HJK seats rotated aft as a unit onto row 41. There was no significant damage to the seatbacks. No damage was noted to the seat cushions or cross tube. The seatpans were bent downward. The forward left leg bent to the left.

The 40ABC seats were in the upright position. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrests. Forward seat track fittings were detached from floor. The seat legs were bent to the left.

The 40DEG seats were intact and tipped back. The forward seat row was tipped back against the seat cushions. The forward set track fittings were detached from the floor and the aft right seat leg was bent to the left and fractured. The aft left seat leg could not be observed. The arm rest between 40E and 40D was bent. The left hand arm rest or seat 40D was broken. The 40D seatpan was broken but still attached.

The 40HJK seats rotated aft as a unit onto row 41. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, cross tube, or armrests. The seatpans were bent downward. The forward left leg bent to the left.

The 41ABC seats were rotated aft laying on the seatbacks facing the ceiling. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, or armrests. The forward seat cross tube was bent downward and fractured at the right end of the tube. All seat track fittings were detached from floor. The seat legs were severely bent to the left.

The 41DEG seats were intact. The seatbacks of the forward seat row were in contact with the forward seat cross tube. The aft seat cross tube was dented at the 41D seat. The lower portions of the 41D and 41E seatbacks were broken. The seatpans were all damaged. The 41G forward left hand seatpan rail was bent at the attachment point and the aft left hand seatpan attachment clip was broken. The 41D and 41E seatpans were fractured at all the attachments. All of the seatbelts were attached and unbuckled.

The 41JK seats rotated slightly aft with seatback against the lav. There was no significant damage to the seatbacks. No damage was noted to the seat cushions, seatpan, cross tube, or armrest. The seat track fittings appeared to be attached to the floor.

The 42AB seats were rotated aft (lying on the seatbacks) in the door 4L doorway, facing the ceiling. Seat 42B seatbelt was intact and buckled. There was no significant damage to the seatbacks. No damage was noted to the seat cushions. The armrests were bent to the left and the seatpan at seat 42B was detached. The forward seat cross tube was fractured at the right end of the tube. The right hand aft leg was attached to the seat track. The seat legs were bent to the left.

The following measurements were obtained from the seatbelt of seat 42B:

- Back of seat from belt attachment to belt attachment = 17 ¼ inch
- Strap length to buckle for belt with buckle length = 16 inches

- Strap length to buckle for belt with non buckle belt = 14 ½ inches
- Total belt circumference is approximately 48 inches
- Length of belt tail out of buckle = 10 5/8 inches

The 42DEG seats were intact and upright. The forward row seats had rotated aft and were in contacts with the seats. There was some damage to the 42G seat back. The 42D seatpan was fractured at all of the attachments. The 42G seatpan forward and aft right hand attachment clips were broken. The 42E seatpan forward left hand rail was bent at the attachment point. The forward right hand seat leg was not attached to the seat rail. The right hand leg was bent left. The remainder of the seat legs could not be observed. The seatbelts were found attached and unbuckled. The 42D and 42E seatbelts was found at the maximum extension.

4.6 Galleys and Lavatories

Galleys

There were three galleys on the accident airplane: a forward galley, a mid-cabin galley between door 2L and 2R, and an aft galley just in front of the aft pressure bulkhead.

The forward galley at door 1R had all of the galley bins secured with quarter turns and the two refrigerator units at position F2-07 were secured. The galley cart at position F2-01 had its quarter turns engaged, door secured, and foot brake unlocked. The galley cart at position F2-02 had its quarter turns engaged, door secured, and foot brake locked. The galley cart at position F2-03 had its quarter turns engaged, door secured, and foot brake locked. The galley cart at position F2-04 had its aft quarter turn disengaged, door secured, and foot brake unlocked. The galley cart at position F2-05 had its quarter turns engaged, door secured, and foot brake locked. The galley cart at position F2-06 had its quarter turns partially engaged (45 degrees), door secured, and foot brake locked. The galley cart at position F1-01 had its quarter turns engaged, door secured, and foot brake locked. The galley cart at position F1-02 had its outboard quarter turn disengaged, inboard quarter turn partially engaged (45 degrees), door secured, and foot brake locked. All of the ovens were closed and locked. The galley cart at position F3-01 had its quarter turns engaged, door secured, and foot brake locked. The galley cart at position F3-02 had its forward quarter turn engaged, aft quarter turn disengaged, door secured, and foot brake locked. The galley cart at position F3-03 had its quarter turns engaged, door secured, and foot brake locked.

The galley between doors 2L and 2R had significant fire and smoke damage and the ceiling was consumed by fire. The majority of the fire damage was on the right hand side. The galley cart position M1-1 had its quarter turns engaged and door secured. The door would not open. The galley cart position M1-2 had its inboard quarter turn engaged, outboard quarter turn disengaged, and door secured. The galley cart position M1-3 had its quarter turns engaged and door secured. The door would not open. The galley cart position M1-4 had its quarter turns engaged and door secured. There was fire damage to

the door. The galley cart position M1-5 had its quarter turns engaged and door secured. There was fire damage to the door. The galley cart position M1-6 had its quarter turns unlatched, the outer door was open with fire damage, and the cart door was also unlatched with smoke damage. The oven door was found unlocked but closed with fire damage. There were 5 galley bin positions across the top of the forward galley unit. Each position held 2 galley bins in depth. The second galley bin position from the right was missing the front bin. The back bin was pushed outward and was 6.75" from the galley face. The missing galley bin was found with the deflated 2R slide/raft near door 2L. At galley positions M1-16 and M1-11 the galley bins were closed and latched. Galley position M2-7 had the door closed, quarter turns unlatched, cart brake unlocked, and cart latches open. Galley position M2-6 had the door closed, quarter turns unlatched, cart brake unlocked, and cart latches open. Galley position M2-5 had the door closed, quarter turns unlatched, cart brake unlocked, and cart latched. Galley position M2-4 had the door burned and closed, quarter turns unlatched, cart brake unlocked, and cart latches open. Galley position M2-3 had the door burned and closed, quarter turns unlatched, cart brake unlocked, and cart latched and unable to open. Galley position M2-2's door was burned and closed, inboard quarter turn unlatched, and outboard quarter turn latched. Galley position M2-1 was a trash compartment that was burned and closed.

The aft galley at door 2 had the oven doors closed but unlocked with no fire damage. The galley bin in position M2-11 had the outboard latch disengaged and the inboard latch engaged. Both latches for galley bin in position M2-12 were latched. All coffee makers were secured in place.

The aft galley was destroyed in the airplane's initial impact and slide down runway 28L. The Survival Factors Group documented the location of significant items of mass with the assistance of the FBI's total station surveying equipment. The documentation focused on items with a Boeing part number that could be identified as originating from a particular location on the airplane. The first identifiable item from the airplane cabin was a small section of galley floor that was found just beyond the seawall. Locations of selected items can be seen in the figures below:

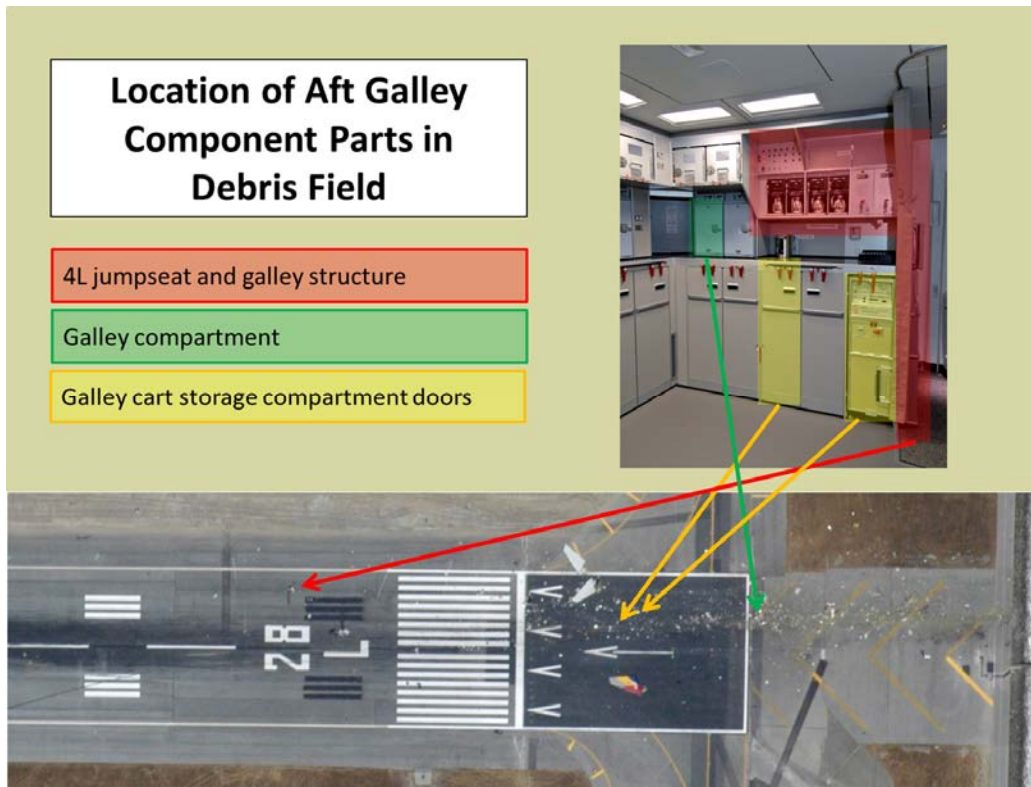


Figure 3. Location of 4L jumpseat and aft galley components in the debris field.

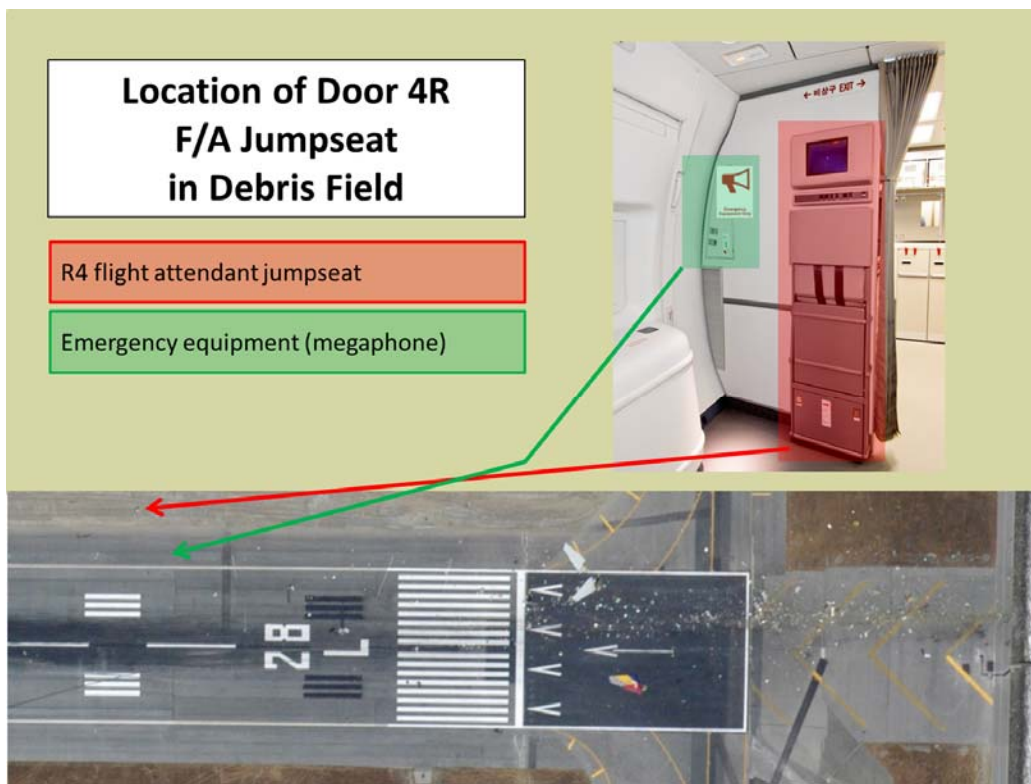


Figure 4. Location of 4R F/A jumpseat in debris field.

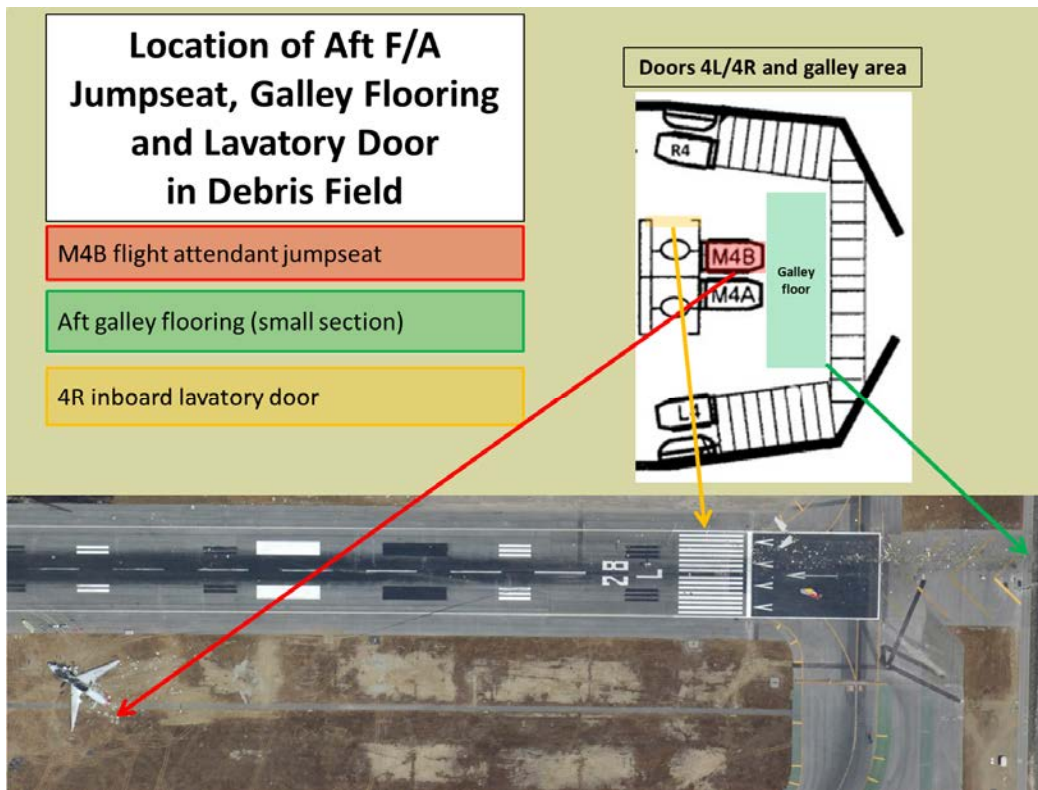


Figure 5. Location of aft jumpseat, galley floor, and lavatory door in the debris field.

Lavatories

There were nine lavatories on the airplane: two just aft of the cockpit door, one aft of door 2R, two near door 3L, one forward of door 3R, two near door 4R, and one near door 4L. The four lavatories near doors 2R, 3L, and 3R were either completely or partially consumed by the post-crash fire.

Forward Lavatory (closest to the cockpit)

The PSU was hanging down but was still on the hinges. No damage was noticeable except heavy smoke/soot deposits. There was no evidence of fire intrusion.

Forward lavatory (adjacent to 1L)

The PSU was hanging down but held in place by a gasper hose and wire harness. There were light smoke deposits inside on the horizontal surfaces. The amenity cabinet door was open.

Aft Lavatory - Forward of Door 4R

The lavatory door was missing. The toilet shroud was missing, the compartment door was open, the water shutoff valve was in the open position, and the PSU was not identified. The aft wall, mirror, and ceiling were broken. The interior wall was missing and the under cabinet door was missing.

Aft Lavatory Right Center – Door 4R

The lavatory was sheared off of its supports and displaced 32 inches aft with the center overhead bin run was resting on the lavatory wall. The lavatory door was missing. The aft wall (containing the M4B F/A seat) was located approximately 50 feet of the aft pressure bulkhead. The toilet shroud was gone and the toilet was partially bolted in place. The ceiling was missing and the PSU was not identified.

Aft Lavatory Left Center – Door 4L

The ceiling was missing and portions overhead bin structure was hanging inside the lavatory. The PSU was not identified. The lavatory door was missing. The lavatory was tilted off of the forward supports and the aft panel was sheared off of its supports.

4.7 Overhead Bins

The fire damage to the passenger cabin extended from just forward of Door 1 L/R and aft to above Door 3 L/R. All of the overhead stowage bins in those areas were completely consumed except for 2 outboard bins aft of the 2R lavatory at rows 10 and 11 (STA 848 to STA 909) and 3 overhead center bins (right side) aft of the mid-cabin galley at rows 10, 11, and 12 (STA 848 to STA 930) that were partially consumed. See table 2 below for information about the remaining overhead bins in the cabin. All of the bins were rated to hold 75 lbs. except for row 30 inboard (35 lbs.) and rows 39 and 40 (85 lbs.). Despite the firefighting activities, the contents of the overhead bins were not wet; therefore, each bag was weighed after its location was documented and total bin content weights were calculated.

Row	Left Aisle Outboard	Left Aisle Inboard		Right Aisle Inboard	Right Aisle Outboard
10	Consumed by Fire	Consumed by Fire		Consumed by Fire	Bin closed Empty
11	Consumed by Fire	Consumed by Fire		Consumed by Fire	Bin closed 3 bags (43lbs)
29	Bin open Empty	Bin open Empty		Bin open 1 bag (19.9 lbs)	Bin open Empty
30	Bin closed Empty	Bin closed Empty		Bin closed 2 bags (20.13 lbs)	Bin open 1 bag (7.3 lbs)
31	Bin closed Empty	Bin closed Empty		Bin open Empty	Bin open 4 bags (28.12 lbs)
32	Bin open 1 bag (4.2 lbs)	Bin open Empty		Bin closed Empty	Bin closed 2 bags (7.12 lbs)
33	Bin closed Empty	Bin closed Empty		Bin closed Empty	Bin closed Empty
34	Bin closed Empty	Bin open Empty		Bin closed Empty	Bin open Empty
35	Bin open Empty	Bin open Empty		Bin open 1 bag (10.11 lbs)	Bin closed Empty
36	Bin open Empty	Bin closed 1 bag (9.7 lbs)		Bin closed Empty	Bin open 2 bags (17.12 lbs)
37	Bin closed 2 bags (52.11 lbs)	Bin closed 3 bags (54 lbs)		Bin closed Empty	Bin open 1 bag (24.5 lbs)
38	Bin closed 2 bags (48.6 lbs)	Bin open 3 bags (40.6 lbs)		Bin closed 3 bags (12 lbs)	Bin closed Empty
39	Bin closed Empty	Bin closed 5 bags (20.6 lbs)		Bin closed 2 bas (17.7 lbs)	Bin closed Empty
40	Bin closed 3 bags (47.11 lbs)	Bin closed 3 bags (37.12 lbs)		Bin closed Empty	Bin closed Empty
41	Bin closed Empty	Bin closed Empty		Bin closed Empty	Bin closed Empty
42	Bin closed 2 bags (11.14 lbs)	Bin closed 1 bag (11.3 lbs)		Bin closed Empty	Lavatory wall

Table 2. Overhead bin contents and weights.

4.8 Passenger Service Units

The following table includes the documentation of the passenger service units on the airplane that were not consumed by fire.

Passenger Service Units located in Zone C																	
Passenger Service Units - Seats ABC					Passenger Service Units - Seats DEG					Passenger Service Units - Seats HJK							
Oxygen Generators																	
Row	O2 Door Deployed	O2 Door Stowed	missing	Oxygen Generators		O2 Door Deployed	O2 Door Stowed	missing	Activated		Not Activated		O2 Door Deployed	O2 Door Stowed	missing	Oxygen Generators	
				Activated	Not Activated				Fwd Gen	Aft Gen	Fwd Gen	Aft Gen				Activated	Not Activated
29	No Row 29 on left side of Airplane							X					No Row 29 on right side of Airplane				
30	X			X				X								X	
31	X			X		X			X			X	X			X	
32	X			X		X			X			X			X		
33	X			X		X			X			X	X			X	
34	X			X		X				X	X				X		
35			X			X					X	X	X			X	
36	X			X		X					X	X	X			X	
37		X			X	X					X	X	X			X	
38	X			X		X					X	X			X		
39	X			X				X							X		
40	X			X				X							X		
41	X			X				X					X			X	
42	X			X		X				X	X		No Row 42 on right side of Airplane				

Table 3. Condition of passenger service units.

4.9 Airplane Exterior

The Survival Factors Group noted four circular-shaped holes in the airplane's fuselage. On the airplane's right side there was a hole near the 2R lavatory (station 835), above row 14 (station 972, even with top of door frame), and above row 17 (station 1108, on stringer above door frame). On the airplane's left side there was a hole just aft and above door 2L (at station 825).

Measurements of the holes were as follows:

Right side, 2R lavatory: 1 3/4" tall by 1 1/8" wide

Right side, row 14: 2 1/4" tall by 2 1/4" wide

Right side, row 17: 2 1/4" tall by 2 1/4" wide

Left side, door 2L: 5 5/8" tall by 3 1/4" wide

5.0 Additional Documentation and Testing

5.0.1 Slide/raft Teardown Examinations

As described in section 4.1, several items from the emergency evacuation systems of the accident airplane were retained and shipped to Air Cruisers Company (Air Cruisers) in Wall Township, New Jersey for teardown examinations. Members of the Survival Factors Group met at Air Cruisers on July 30-31, 2013. The group activities included teardowns of four slide/raft assemblies (1R, 2R, 3L and 4R). This included

examinations of both the slide/raft inflatables as well as the slide/raft packboards. Additionally, the group examined the 3R and 4L packboards (but not the slide/raft inflatables).

Before starting the teardowns, Air Cruisers presented background information regarding the B777 slide/raft certification process. It was explained that inertia load testing for slide/raft certification was specified by the FAA and Boeing. The testing was conducted at the Dayton T. Brown laboratory in Bohemia, NY in January and February 1995. The test was conducted by attaching the slide/raft assembly to a test fixture that simulated the installation on the door at the end of a long centrifuge arm and rotated to a revolutions per minute (RPM) calculated to achieve the required G-loads at the slide/raft's center of gravity. Starting from a stationary position the RPMs were increased to the desired RPMs and maintained for a minimum of 3 seconds; and then decreased back to a stationary position. The slide/raft was required to remain intact on the fixture and stay within its allowable pack envelope and ultimately to deploy from an aircraft door or equivalent test module.

During the 777 certification inertia load testing the following loads were applied: 9G forward, 3G inboard/outboard, 3.8G upward, 6.8G downward and 1.5G aft. There were 8 different door evacuation systems (one per door position) subjected to these loads; 2 separate test cases were developed to accommodate the varying loads (each combining 3 of the 6 load vectors). For case 1, a 9G forward, 3G inboard and 3.8G upward load was applied. The resultant load factor for case 1 was 10.2Gs. For case 2, a 1.5G aft, 3G outboard and 6.8G downward load was applied. The resultant load factor for case 2 was 7.6Gs. The tests met the FAA and Boeing requirements for both case 1 and case 2. The resultant loads were not tested to ultimate loads for either case 1 or case 2.

The vibration testing conducted by Air Cruisers during the slide/raft certification was intended to simulate in-service vibrations and conducted as a life cycle endurance testing. This life-cycle testing was accomplished by replicating an accelerated aging method to observe fatigue. The vibration test did not account for an isolated, singular event like an accident.

Air Cruisers had no knowledge of any prior similar interior slide/raft deployments from slide/rafts on the B777. They were only aware of inadvertent slide/raft deployments that occurred during airplane service or maintenance.

Air Cruisers was asked about service bulletins (SB) applicable to the slide/rafts on the accident airplane. Service bulletin 107-25-30 issued by Air Cruisers addressed the slide/raft release housing. The reason for the service bulletin was that some slide/raft release housings were found to be experiencing corrosion in service. The service bulletin called for an inspection of the part to be conducted during the 42-month maintenance cycle⁶ and, if corrosion was found or if the part was found to be suspect, the slide/raft

⁶ According to Air Cruisers Company, the recommended maintenance interval for all 777 slide/rafts was every 42 months.

release housing was recommended to be changed. All slide/raft release housings that were new replacement parts were blue in color. The FAA issued Airworthiness Directive (AD) 2013-05-010 on March 29, 2013 related to this issue and required an inspection and corrective action (per Boeing SB 77-25-0507) be performed within 42 months.⁷

Findings from the teardown examinations are below:

1R Slide/Raft Assembly

Slide/Raft Bustle

The 1R slide/raft bustle was a Boeing part manufactured by C&D Zodiac; the date of manufacturing was January 2006. There was a hole located 18-inches above the seal. The aft latch was functional and the forward latch was deformed. The lower brackets were intact. The forward 5 fasteners were pulled through the rubber on the sweeper seal.

Slide/Raft Packboard

Assembly P/N: 65720-102

The 1R slide/raft packboard was manufactured by Air Cruisers in April 2008. Asiana's "Emergency Equipment Condition Tag" was illegible. The packboard contained a blue release housing in accordance with SB107-25-30. Pin shield fasteners (screws) number 1⁸ (inboard and outboard) were missing; number 2 (inboard) was missing; number 5 (inboard and outboard) were missing; number 7 (inboard) was missing. The majority of the fasteners that were present were only finger tight. The interior threads in the holes for the missing fasteners appeared undamaged. The upper latch handle and upper latch hook were functional. There was a deformation/bulge of the slide/raft release shaft in the tang retention slot; however, no fracture or tear was noted. The deformation was noted to be in the direction of pack release. The tang was fully engaged in the slot. Witness marks were present on the tang bearing surface of the pawl. No other damage or shifting of the shaft was noted. The slits in the ball retention pins were noted to be facing inboard. No damage of the pins was noted. The packboard cover release cables appeared normal.

Slide/Raft Inflatable

The inflation cable and the cable guide were intact. The inflation cable had been pulled free of the inflation valve and the Velcro keeper had been disengaged. When the slide/raft was refolded to the head restraints, a puncture/slice was observed 100-inches from the girt bar to 140-inches on both the upper and lower forward side body tubes. Both aspirator flapper valves were intact and appeared to open and close normally when actuated by hand. There were no signs of damage to the aspirators. The head-end link,

⁷ For more information about SB 107-25-30 and AD 2013-05-010 see the Maintenance Records Group factual report.

⁸ The numbering convention used to identify pin, screw, and cable positions began with #1 being aircraft forward.

wrap around restraint, mid-links, and toe-links were all intact and had been released by the Survival Factors Group on-scene in SFO. The inflation valve was subsequently removed from the cylinder and placed on small volume air chuck. It was charged with nitrogen to a normal operating pressure. A handheld pull force gauge was attached to a mock inflation cable and pulled. The gauge records the maximum pull force value. The valve actuated at 7 lbs.

2R Slide/Raft Assembly

Slide/Raft Bustle

The manufacturer of the 2R slide/raft bustle was illegible; the date of manufacture was also illegible. Extensive fire damage observed over entire bustle and sweeper seal. The top aft latch and lower bracket were missing. (The lower bracket was found in the shipping container.)

Slide/Raft Packboard

Assembly P/N: 61949-108

The 2R slide/raft packboard was manufactured by Air Cruisers in August 2000. Asiana's "Emergency Equipment Condition Tag" indicated the slide/raft was manufactured by Air Cruisers in November 2000. The last inspection date by Asiana was February 2012 with the next inspection date August 2015. The packboard contained a blue release housing in accordance with SB107-25-30. There was deformation in the release shaft around the packboard tang retention slot. The release shaft aluminum tube was torn at the tang interface in the direction of pack release. There was a displacement of the tang. The tang was wedged and release shaft was seized. The tang roll pin was not sheared, it was observed pulled through the tang retention hole in the release shaft. Witness marks were present on the tang bearing surface of the pawl. There were heavy witness marks observed for the cable release balls on the inside of the pin shields. All of the release cables were intact on the lower lacing cover stiffener. The lower lacing cover stiffener was exposed because the lower lacing cover fabric was melted. The forward side panel of the upper lacing cover was consumed by fire. No other damage or shifting of the shaft was noted. The slits in ball retention spring pins were noted to be various positions. No damage of the pins was noted. All of the pin shield fasteners were present and intact. The upper latch release handle was operational. There was minor deformation to the upper latch bottom plate notch.

Slide/Raft Inflatable

The girt bar was rotated 90-degrees inboard within the girt sleeve. Both aspirator flapper valves were intact and appeared to open and close normally when actuated by hand. The slide/raft inflation cable was free of the inflation valve and still routed through the Velcro keeper. The slide/raft experienced extensive fire damage.

3L Slide/Raft Assembly

Slide/Raft Bustle

The 3L slide/raft pack bustle was a Boeing part manufactured by C&D Zodiac; the date of manufacturing was January 2006. The latches were functional with no damage to the lower brackets of the bustle. The sweeper seal was intact.

Slide/Raft Packboard

Assembly P/N: 61949-107

The 3L slide/raft packboard was manufactured by Air Cruisers in November 2001. Asiana's "Emergency Equipment Condition Tag" indicated the slide/raft was manufactured by Air Cruisers in March 2002. The last inspection date by Asiana was May 2011 with the next inspection date November 2014. The packboard contained a blue release housing in accordance with SB107-25-30. There was a deformation/bulge of the slide/raft release shaft in the tang retention slot; however, no fracture or tear was noted. The deformation was noted to be in the direction of pack release. The tang was fully engaged in the slot. Witness marks were present on the tang bearing surface of the pawl. The aft ball retention pins at all 8 positions were bent aft and inboard. Witness marks were observed on the ball retention pins. The release cable was fit through each of the roll pins and all had a functional fit when tested. The number 5 cable on the lower lacing cover was fractured/separated. All of the pin shield fasteners were present and intact. The slits in the ball retention spring pins were noted to be in the correct positions. The inboard edge of the rear support of the packboard was bent down. The upper latch handle was unable to be latched in its retention clip. The latch was otherwise functional. One half of the release pill was missing the Teflon coating.

Slide/Raft Inflatable

The head-end link, wrap around restraint, mid-links, and toe-links were all intact. The girt to aspirator straps were disengaged. Both aspirator flapper valves were intact and appeared to open and close normally when actuated by hand. The slide/raft's lighting system activation lanyard was not rigged to the battery nor was the appropriate P/N lanyard present. The effective activation length of the activation lanyard installed on the slide/raft was 19 inches. An additional coiled lanyard was still engaged in the battery activation clip. The date of manufacture for the lighting system battery was February 2010.

Slide/raft inflation cable appeared properly rigged at the girt end. The ball was still fully seated in the inflation valve. The inflation valve was in the armed position. The inflation cable was routed through the Velcro keeper which was not disengaged.

The inflation valve was subsequently removed from the cylinder and placed in a small volume air chuck. It was charge with nitrogen to a normal operating pressure. A

handheld pull force gauge was attached to a mock inflation cable and pulled. The gauge records the maximum pull force value. The valve actuated at 14.4 lbs.

3R Slide/Raft Packboard

Assembly P/N: 61949-108

The 3R slide/raft packboard was manufactured by Air Cruisers in January 2002. Asiana's "Emergency Equipment Condition Tag" indicated the slide/raft was manufactured by Air Cruisers in February 2007. The last inspection date by Asiana was July 2011 with the next inspection date December 2014. The packboard contained a blue release housing in accordance with SB107-25-30.

There was deformation in the release shaft around the packboard tang retention slot. The release shaft aluminum tube was torn at the tang interface in the direction of packboard release. There was a displacement of the tang. The tang was wedged and release shaft was seized. The tang roll pin was not sheared, it was observed pulled through the retention slot in the release shaft. There were witness marks on the pin shield. Witness marks were present on the tang bearing surface of the pawl. No other damage or shifting of the shaft was noted. Only one slit in ball retention spring pin 4 (aft) was rotated 90 degrees. No damage of the pins was noted.

The threaded inserts at the aft side bracket assembly were pulled out of the tray. The side packboard tray rail extrusion was broken in the same area. The top tray of the packboard was bent down at the forward inboard corner. All of the pin shield fasteners were present and intact.

4L Slide/Raft Packboard

Assembly P/N: 65988-101

The 4L slide/raft packboard was manufactured by Air Cruisers in January 2006. Asiana's "Emergency Equipment Condition Tag" indicated the slide/raft was manufactured by Air Cruisers in February 2002. The last inspection date by Asiana was August 2011 with the next inspection date October 2014. The packboard contained a blue release housing in accordance with SB107-25-30.

All of the lower lacing cover cables were fractured except number 5. Number 5 was intact but the aft pin was bent in the aft direction.

The bottom edge of the packboard and the release shaft assembly were bowed. The release shaft showed signs of stress loading around the tang. There was no displacement of the tang. The tang was not wedged but the release shaft could not be turned by hand. It could be rotated with a wrench. All of the pin shield fasteners were present and intact. The slits in ball retention spring pins were noted to be various positions. The upper latch handle and upper latch hook were functional.

4R Slide/Raft Assembly

Slide/Raft Bustle

The 4R slide/raft bustle was a Boeing part manufactured by Northwest Composites; the date of manufacturing was illegible. There was damage to the top middle portion. The aft release latch functioned properly. There was no obvious deformation to the release latches. The lower brackets appeared undamaged. The sweeper seal appeared undamaged and was still attached.

Slide/Raft Packboard

Assembly P/N: 65988-102

The 4R slide/raft packboard was manufactured by Air Cruisers in January 2007. Asiana's "Emergency Equipment Condition Tag" indicated the slide/raft was manufactured by Air Cruisers in April 2007. The last inspection date by Asiana was December 2010 with the next inspection date October 2013. The packboard contained an unsealed (gray) center release housing. No corrosion was observed on the release housing.

The top of the slide/raft packboard was twisted downward at the forward inboard corner. There were two elongated pin holes on the top plate holding the latch handle and scrape marks observed on the top of the release hooks. The upper latch handle on the packboard was not able to be secured in plastic handle retention clip. The retention clip was broken on the aft side of the clip.

There was deformation in the release shaft around the packboard tang retention slot. The release shaft aluminum tube was torn at the tang interface. There was a displacement of the tang. The tang was wedged and release shaft was seized. The tang roll pin was not sheared, it was observed pulled through the tang retention hole in the release shaft. Witness marks were present on the tang bearing surface of the pawl. The release shaft was shifted aft and was pressed against the bushing. The slits in ball retention spring pins were noted to be in the normal positions. No damage of the pins was noted.

There were two puncture holes on the exterior of the packboard tray, one on the forward right side and one in the center of the packboard. There was no damage observed to the lower mounting brackets. All of the pin shield fasteners were present and intact. The lacing cover release cables 2 and 8 were frayed including the cutting of individual strands. The lacing cover adjacent to number 8 exhibited abrasion damage. There was a tear to the aft side of the upper lacing cover in the area of the valve safety pin access hole. Witness marks were observed on the balls of the release cables on the lower lacing cover.

Slide/Raft Inflatable

The girt was completely separated across its full width and the portion remaining attached to the girt bar was pulled aft. The 4R anti-rotation link that was normally on the girt was not present. The head-end link, wrap around restraint, mid-links, and toe-links were all intact. The inflatable appeared consistent with no air being pumped into the slide/raft. Both aspirators exhibited denting and scraping; the flapper valves functioned properly when actuated manually by hand.

The plastic cable guide tube on the inflation bottle was broken off at the attachment and the remaining portion was missing. The cable adapter on the valve was pushed downward towards the reservoir. The pulley was in the fully-closed position with the safety pin installed in the valve. Upon removal, the safety pin was intact with no damage observed to the shaft; the D-ring was missing from the pin. The safety pin lanyard with key ring was found in the stowage pocket.

The manual inflation cable was broken and 60 inches remained in the valve. No manual inflation handle was present on the girt and the inflation cable grommet was torn through the girt and not present.

5.0.2 Tensile Pull Testing

On November 7, 2013, members of the Survival Factors Group met at Air Cruisers to conduct a series of tensile tests on B777 packboard release mechanisms. The stated goals for the testing were to:

- Understand the level of force that needed to be applied to the release mechanism to cause the lower lacing cover to release from the mechanism
- Replicate the same type of damage seen on the packboard release mechanisms from the accident airplane

Six B777 packboard release assemblies were subjected to ultimate failure loads according to test plan EDN-4105. The peak loads were recorded and ranged from 1465.8 lbs. and 1766.5 lbs. under a variety of different directions and test conditions. The test results approximated the types of damage and final resting positions of the roll pins as were seen on some of the release mechanisms from accident airplane. See attachment 7 for the test plan and detailed testing results.

6.0 Asiana Airlines Fleet Inspection

In response to the findings at the July 30-31, 2013 teardown examinations at Air Cruisers, Asiana Airlines performed a voluntary inspection of their 12-airplane B777 fleet (including spare slide/rafts) looking for any of 3 abnormal conditions: the presence of a safety pin in a slide/raft's inflation cylinder, an incorrect power unit activating lanyard, and loose or missing packboard pin shield cover screws. There were no abnormal findings on 11 of the 12 airplanes. The last airplane (HL8284; delivered on

July 13, 2013) had an abnormal condition with the pin shield cover screws on 6 of the 8 slide/raft packboards. Workcards from the inspection indicated that the screws were retightened prior to returning the airplane back into service and a warranty claim was submitted to Boeing (see attachment 8).

7.0 Emergency Response

Members of the Survival Factors group interviewed 24 members of the SFFD, 7 SFPD officers, and 6 SFO airfield safety officers about the emergency response to the accident. Those interviews are included as attachment 9 of this report. Statements from all SFFD personnel who responded to the scene were requested and are included as attachment 10. Additionally airport video camera footage, SFFD ARFF vehicle camera footage, as well as video captured by a helmet camera worn by a firefighter were reviewed. Video from airport cameras 225 and 5119 was most useful in the establishment of the of a detailed response timeline and has been included as attachments 11 and 12.

During the on-scene phase of the investigation in SFO, the Survival Factors group met with SFO Communications staff and used the Naval Observatory's master clock phone number [202-762-1401] to perform a real-time comparison with the various clocks used at the airport – specifically, the clock used for the video cameras, the clock used for the computer-aided dispatch (CAD) system, and the clock used for the radio system. This was done in an effort to establish a single timeline and allowed for corrections to be made to clocks that were not already synched to Naval Observatory time. This allowed investigators to create an accurate timeline while using multiple sources of airport information. The CAD system and radio recordings were 4 seconds fast when compared to Naval Observatory time and that the videos cameras were one second fast compared to Naval Observatory time. Additional sources of video information (the firefighter's helmet camera footage and in-truck footage from ARFF vehicle Rescue 10) were also synched to the timeline by using common events recorded on them and one or more airport cameras. The timeline is included as attachment 13 of this report and summarized in the section.

7.1 Emergency Response Timeline Narrative

Multiple individuals viewed the accident from different locations on the airport and the response to the accident was almost immediate. The accident was captured on airport camera C225 with the initial impact occurring at about 1127:48 and the airplane coming to a stop at about 1128:03. Most of the airport emergency responders learned of the accident via an Alert 3 “ringdown” from the air traffic control tower at 1128:00.

The first vehicle to arrive on-scene was an Airport Operations pickup truck driven by an ASO at 1130:16. At that time the evacuation at doors 1L and 2L had been underway for about 25 seconds. The first SFFD ARFF vehicle to arrive was Rescue 88 at approximately 1131:11. It positioned at approximately the 1 o'clock position and began to apply agent to the visible fire involving the number 2 engine that was against the right

side of the fuselage, near door 2R. Rescue 9 arrived about 37 seconds later and also began applying agent to the fire. Within approximately 20 seconds of its arrival most passengers had finished evacuating from doors 1L and 2L. By 1133:02 SFFD had 7 firefighting vehicles on-scene in various positions around the airplane. Additionally, two SFFD rescue vehicle had taken position on taxiway F in the location that would become the triage area. At 1136:53 Rescue 10 was repositioning near the left wing in order to lay a foam blanket in front of the left wing where there was a fuel leak. On-vehicle camera footage showed several firefighters on the ground, one of whom directed Rescue 10 around a victim lying in the grass near a cart path forward of the left wing.

At 1138:37 three firefighters can be seen climbing the 2L slide/raft with a handline and entering the cabin. In their statements, these firefighters described climbing the 2L slide/raft with a handline to enter the cabin. One firefighter went forward and searched the cockpit and forward cabin while the other two went aft down the airplane's left aisle. Visibility was hazy but one of these firefighters recalled seeing that the cockpit door was open when they entered the airplane. As he moved aft he saw fire on the right side of the airplane spreading upward toward the overhead bins. He sprayed water on the fire to knock it down and continued aft past door 3L. There were approximately 4-6 passengers still remaining in C-zone and a flight attendant was attempting to assist them. Some passengers were pinned beneath seats and others stayed with them to try to help. Other firefighters entered C-zone through the hole in the back of the airplane and assisted with victim extrication and removal from the airplane. Based on information from multiple sources, it was likely that the last victim was extricated from the back of the airplane about 1147.

About 2 minutes later Rescue 9 began raising its High Reach Extendable Turret (HRET), which was the first indication of an attempt to elevate that piece of equipment by either Rescue 9 or Rescue 10 (the only two trucks equipped with an HRET).⁹ At the same time Rescue 10 was positioned at 9 o'clock and shooting foam from its roof turret onto the door 2L area from beyond the left wing tip. At 1148:34 Rescue 10 began to slowly advance perpendicularly to the airplane while using its bumper turret intermittently. In-vehicle video footage showed the motionless victim in front of the left wing lying in a right lateral recumbent (fetal) position and covered by a layer of foam as Rescue 10 approached. Rescue 10 rolled over the victim at approximately 1150:46. At 1158:37 Rescue 37 arrived in the area of the 1L slide/raft after Rescue 10 had departed and was directed by fire attack chief to put agent into door 2L. Rescue 37 complied but ran out of water and departed the area by making a sweeping right turn in front of the left wing. During this turn Rescue 37 rolled over the victim in front of the left wing at 1201:11. Shortly thereafter, the victim (no longer covered due to the displacement of foam by the vehicle tires) was pointed out to the fire attack chief. He reported the victim over the radio and had the body covered with a blanket at 1206:29. (For more information about this fatality, see section 8.2)

⁹ Rescue 10 pierced the airplane in the area above and aft of door 2L at approximately 1152:42 and withdrew the piercing tip 50 seconds later. The tip was broken at that time and hanging from the end of the HRET.

The heavy black smoke abated and the fire was brought under control about 1218:30 after simultaneous, elevated attacks by both Rescue 9 and Rescue 10 using the burn-through holes in the crown of the airplane as entry points for the application of water and foam.

8.0 Medical and Pathological Information

8.1 Survivors

An EMS transport spreadsheet provided by the SFFD to the NTSB upon arrival on-scene indicated that 179 occupants were transported to 12 local area hospitals for treatment. The NTSB subpoenaed patient transport/treatment information from the local area hospitals. Information provided by the hospitals indicated that 201 passengers and 10 crew were treated at 13 local area hospitals after the accident. The name of the hospital and number of patients treated is below:

California Pacific Medical Center, Pacific Campus (7 passengers)
Eden Medical Center (2 passengers)
Kaiser Foundation Hospitals - San Francisco (5 passengers)
Kaiser Permanente Oakland Medical Center (1 passenger)
Kaiser Permanente Redwood City Medical Center (8 passengers + 2 crew)
Mills-Peninsula Health Services (33 passengers + 3 crew)
Saint Francis Memorial Hospital (7 passengers)
San Francisco General Hospital (60 passengers + 3 crew)
Sequoia Hospital (5 passengers)
St. Luke's Hospital (2 passengers)
St. Mary's Hospital and Medical Center (4 passengers)
Stanford Medical Center (53 passengers + 2 crew)
UCSF Medical Center (14 passengers)

Patient medical records were subpoenaed but not all had been received as of the date of this report. Injury summaries based on a review of the medical records will be added as an addendum to this report.

8.2 Fatalities

Passenger 41E

The 16-year-old female passenger was found in front of the airplane's left wing. An autopsy was performed by the San Mateo County Coroner's Office. The cause of death was determined to be "multiple blunt injuries" and the manner of death to be "accident."

According to the autopsy report, there was "a moderate amount of dirt and plant material present on the body" which was "especially noticeable in the scalp and on the surface of clothing exposed to the exterior. It is also noticeable on the left foot and left lower leg." The report also stated, "Dirt is present on the pants. The dirt is most obvious in the

gluteal area and the backside of the left leg... There is a scant amount of dirt and plant material on the backside of the body most obvious on the backside of the left shoulder and the left lateral side of the back” but “no obvious tire imprints are identified. In addition, no obvious grease or petroleum-type product is noted.”

The autopsy report noted that there was “extensive traumatic blunt injury to the head and face. There is a large laceration across both frontal areas measuring about 9 inches in greatest dimension... Extending inferiorly from this laceration is abrading of the skin. Parts of this extend onto the neck. These are brush-burn in character and many of the striations are oriented in a roughly vertical direction. Their color is mostly yellow, brown and black; however, areas of red discoloration are also noted.”

On the scalp, “there is a very prominent area of the red- purple, glistening soft tissue hemorrhage present about the right side of the cranial vault measuring 5 inches in greatest dimension. There is also a 1-1/2 inch area of hemorrhage present in the left occipital area. The cranial vault is opened through numerous comminuting fracturing” primarily on the left... There is extensive traumatic disruption to the brain especially the left cerebral hemisphere... Diffuse areas of subarachnoid hemorrhage, although scant in amount, are identified over the surface of the brain.”

The autopsy described extensive contusions and abrasions of the extremities and anterior torso as well as open fractures of the right humerus and left wrist and closed fractures of the left humerus and left femur. Small amounts of soft tissue hemorrhage were described in association with these fractures.

Within the chest, there were “bilateral hemothoraces ...totaling each about 150 cc in amount” with intact ribs and a “6 inch laceration to the left hemidiaphragm.” In addition, “there is an open defect consistent with a tear of the aorta at the level of the ligamentum arteriosum. This measures about 5/8 of an inch in greatest dimension. It is surrounded by a copious amount of red-purple, glistening soft tissue hemorrhage. This soft tissue hemorrhage extends up into the neck and down in the direction of the peritoneal cavity.”

Trachea and bronchi are “lined by moderate amounts of bloody material,” and the lungs are described as “prominently congested and edematous” with multiple bilateral contusions. The “lung parenchyma reveals small amounts of intraparenchymal aspiration of blood present. Airways contain very small amounts of bloody material.”

In the abdomen, “an extremely scant amount of hemoperitoneum is present (less than 100 cc).” The liver appears normal but the “parenchyma is pale. In addition, lacerations are present to the undersurface of the liver. There is one laceration on the undersurface of the left lobe that is stellate shaped and measuring about 2-1/2 inches in greatest dimension and extending about 1/2 inch into the liver parenchyma. There is a 3 inch laceration to the undersurface of the right lobe of the liver. This extends about 1/2 inch into the liver parenchyma.” The spleen has “several lacerations ... in the hilar area. These range upwards to 2 inches in greatest dimension and extend 1/2 inch into the splenic

parenchyma.” In addition, “there is a small hematoma surrounding the left kidney. This totals about 50 cc in amount.” The kidneys appear normal but the “parenchyma is pale consistent with ischemia.”

“There is some comminuting fracturing to the right side of the pelvis. This involves the pubic bone, as well as a separation to the sacroiliac joint. Extremely scant amounts of hemorrhage are noted in association with this. Soft tissue is partially taken down from the left pelvis. There is a fracture to the left pubic bone. In addition, soft tissue hemorrhage is noted about the left iliac crest.”

Passenger 41B

The 16-year-old female passenger was found on runway 28L, approximately 1,100 feet from the main wreckage. An autopsy was performed by the San Mateo County Coroner’s Office. The cause of death was determined to be “multiple blunt injuries” and the manner of death to be “accident.” The body had extensive contusions and abrasions to the torso and extremities.

On examination of the head, the autopsy found a “4 inch laceration with some abrading along its edges in the left parietal area” and “extensive black brush-burn abrasions involving the right and left sides of the forehead extending down into the left orbital and left zygomatic area.” The latter “measures 6 inches horizontally and 5 inches vertically” and “within the left forehead portion of this is absence of the skin exposing underlying skull bone. In addition, “there is an area of red-purple, glistening soft tissue hemorrhage in the left frontal area.” Underlying that, “there is comminuting skull fracturing measuring about 4-1/2 x 1-1/2 inches... accompanied by a dural laceration about 3 inches in length and a laceration to the left cerebral hemisphere also about 3 inches. This laceration extends about 1/2 inch into the brain parenchyma.” There is also a “moderate amount of subarachnoid hemorrhage most obvious about the left cerebral hemisphere. Finally, a hinge fracture... extends from the left middle fossa in the area of the comminuting and depressed skull fracture, across the sella turcica area, and over into the right petrous ridge. It ends at the lateral aspect of the right petrous ridge.”

No internal injuries were identified in the chest or abdomen and no fractures were noted other than of the skull. However, examination of the lungs found, “Pleural surfaces are smooth. Prominent congestion and edema is present. In addition, there is a prominent degree of intraparenchymal aspiration of blood. This involves all five lobes; however, it is most obvious in the right middle lobe area.”

Passenger 42A

The 15-year-old female passenger was taken to the hospital from the scene and died 6 days after the accident. The San Mateo County Coroner’s Office investigated and performed an external examination along with reviewing the patient’s medical records. There was evidence of surgical procedures (bandaged, sutured wounds) on the scalp and abdomen. The body was noted to have severe anasarca as well as multiple contusions and abrasions on the torso and extremities. The cause of death was determined to be “multiple organ dysfunctions due to multiple traumatic injuries” and the manner of death

was found to be “accident.” At the request of the family, no internal examination was performed.

9.0 Airport Information

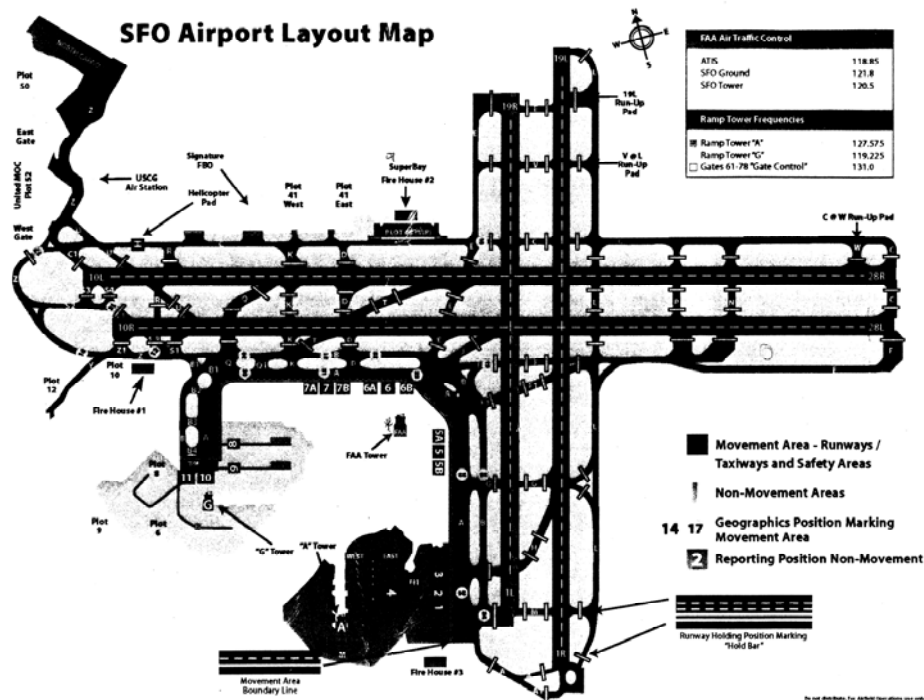


Figure 6. SFO Airport layout.

San Francisco International Airport (SFO) was located approximately 8 statute miles southeast of San Francisco, and was owned and operated by the City and County of San Francisco. The airport property encompassed approximately 5,207 acres at an elevation of 13 feet above sea level. For the 12-month period ending December 12, 2012, SFO had approximately 430,812 total aircraft operations. The FAA certified SFO as a 14 CFR Part 139 airport with Index E aircraft rescue and firefighting (ARFF) capabilities.

SFO had a total of four operational runways that were certificated under 14 CFR Part 139 for use by scheduled air carriers operating aircraft designed for 10 or more passenger seats, and unscheduled air carriers operating aircraft designed for 31 or more seats (See figure X). Two parallel runways were oriented northwest/southeast (Runway 10L/28R and Runway 10R/28L), and two parallel runways were oriented northeast/southwest (Runway 01L/19R and 01R/19L).

SFO Runway 28L consisted of grooved asphalt that was 11,381 feet in length and 200 feet wide. It was marked as a precision instrument approach runway. It was equipped with high-intensity runway edge lights (HIRL) and runway centerline lights. It had a medium-intensity approach lighting system (MALSR), and a 4-light precision approach path indicator (PAPI) set at 2.85 degrees.

Prior to the accident SFO was in the process of a runway safety area (RSA) improvement project with the goal of increasing the RSAs at the approach ends of runways 28L/28R. Runway 28L was closed for repaving/remarking on Monday, June 24 and reopened on Saturday June 29. The threshold was moved west toward the terminal 300 feet, providing a total of 600 feet for the runway safety area. An Engineered Material Arrested System (EMAS) installation project for runways 1L/19R and 1R/19L was scheduled to begin in 2014.

The approach glideslope antenna and precision approach indicator (PAPI) had been moved as a result of the threshold movement. The PAPI was operational but the glideslope was out of service. It was supposed to be flight checked on July 8, 2013. The localizer was functional at the time of the accident. No taxiways were renamed and the existing lighting was only changed for the distance remaining markers.

The airport's last FAA annual certification inspection occurred April 19, 2013. SFO provided copies of FAA inspections and Letters of Correction resulting from those inspections from 2010-2013. A review of the documents did not reveal relevant information that would have affected Asiana flight 214 or the emergency response to the accident.

9.1 SFO Emergency Medical Buses

SFO had two medical buses (291 and 292) stored at the Airfield Safety Building. According to SFO airport operations, neither bus was driven to the accident site triage area by an ASO because all of the ASOs were either at the crash site or busy escorting ambulances or mutual aid fire vehicles from the vehicle access check points to the scene of the crash. As of November 21, 2013, SFO had no information to indicate that any requests were made by SFFD for the emergency medical buses to respond to the accident site.

At 1238 the Operations Supervisor received a request, via the airport's communications radio system, from the Airport Duty Manager, for the two medical buses to be brought to the ramp level of Gate 91. The Operations Supervisor relayed the request to a member of his staff, an Airfield Safety Officer who actually drove the bus to Gate 91. One of the two buses (291) would not start. The other responded to Gate 91. According to the ASO who drove the bus, the fire department wanted to use the backboards from the bus to transport passengers from the triage area in the level two in-transit lounges down to waiting ambulances on level one. All ASOs on all shifts are trained and expected to be able to drive the buses to any on-airfield location for use by medical trained responders.

Both buses 291 and 292 were both manufactured by GILLIG in 1984. Airfield operations personnel start and run the buses once a month and performed a visual check. Both buses were inspected and started without difficulty on May 25th, June 9th, and July 4, 2013. The airport auto shop performed a yearly (October) check on the buses.

Below is an excerpt page 3-5 from the SFO Emergency Operations Manual (dated March 2013, FAA approved on 12/26/2013) that described the duties of airfield safety personnel in the event on an Alert 3 at the airport.

Airfield Safety personnel perform the following additional response and recovery actions:

- deliver vehicles M-212, M-291, M-292, and M-293 to staging area or crash site
- escort emergency response and other vehicles on the AOA as required
- establish Preferred Standardized Emergency Response Pattern (PSERP)
- provide barricades for crash site
- mark locations of objects moved
- assist with fuel hydrant shutdown if required
- designate and mark the helicopter landing zone(s)
- relocate aircraft and equipment hindering emergency response operations and access
- designate routes for response and recovery vehicles and coordinate with Police for security and control of vehicles along the routes

When asked for the airport's interpretation of these responsibilities, SFO Chief Operating Officer responded via email that:

“The list of vehicles delivered by airfield refers to the full fleet of Emergency vehicles which may potentially be deployed. The specifics of an incident will determine what equipment needs to be deployed. Equipment is delivered as appropriate, as requested and as personnel are available. Generally the Mobile Command Post CP is delivered immediately for all events. Medical, Communications and MBS are event specific and delivered upon IC request.”

The entire Alert 3 section and checklist from the SFO Emergency Operations Manual is included as Attachment 14.

Jason Fedok
Survival Factors Investigator

Attachments

- 1.) Photographs
- 2.) F/A Interview Summaries
- 3.) F/A Statements and Translations
- 4.) Passenger Interview Summaries
- 5.) Passenger Questionnaires
- 6.) NTSB Materials Laboratory Report
- 7.) Test Plan and Results of Tensile Testing
- 8.) Asiana Airlines Fleet Inspection Summary

- 9.) Emergency response Interviews
- 10.) Emergency Response Statements
- 11.) SFO Airport Camera Video C225
- 12.) SFO Airport Camera Video C5119
- 13.) Emergency Response Timeline
- 14.) Sections from SFO Emergency Procedures Manual